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A Retrospect.

WITHOUT reluctance, other than that which many of us feel that another year of life has passed, we ring down the curtain on the year 1912. For a year of persistent gloom in regard to home, social, and political events, foreign affairs, and atmospherical conditions, this one which closes to-day would be hard to beat. At home, there have been the coal strike, the attempted national strike of transport workers, which at any rate disorganized work at the Port of London, and the strike on the North-Eastern Railway. Politically, affairs have been continually in a feverish state. There was also the terrible *Titanic* catastrophe. Abroad, there were the final scenes in the trouble between Italy and Turkey; there has been the Balkan war, which threatened at one time to disturb the peace of the whole of Europe. Atmospherically, there has been complete sympathy with other conditions that have ruled, and that have engrossed the attention of the country and of the world, and interrupted the even tenor of the country's and the world's movements. It has been a year of modest sunshine, of a satiety of overcast skies, rain, and atmospheric humidity, and temperatures have changed with most unpleasant frequency and rapidity. Humanity generally will be glad to be relieved of such another year for long to come. But withal, save during the period of the stoppage of the coal supply, and during the immediately succeeding period of resuscitation, the trade of the country has been good—the last Board of Trade returns showing that, for the eleven months of the year to the end of November, the value of the imports was £670,883,764 (increase £55,436,248), of exports £445,974,964 (increase £30,264,383), and of re-exports £102,595,998 (increase £8,555,048). A remarkable showing is made by the coal exports, the increase in value being £3,724,524; while owing to the coal strike, up to the end of April there had been a decrease of £2,834,412. The increase for the eleven months is significant. It speaks of anxiety abroad to obtain British coals; and it also indicates the higher values.

The Stock Exchange, however, reflected the general conditions—the uncertainties and the anxieties of labour, political and foreign questions kept affairs in almost a perpetually speculative and depressed state. The few rays of sunshine that at any time did favour quickly succumbed to the nebulæ of events. Consols and other gilt-edged securities reflected the tetchiness and instability of the conditions that influence affairs in the Stock Markets. We found Consols at 77-77½ at the beginning of the year; during the first half of the year, they vacillated to such an extent that at one time they touched 73½. There was a better feeling towards the middle of the year, and a recovery set in. But with the rumours of trouble in the Near East and of the possibility of international complications, Consols again received a shock; and quite in recent times when there was talk of a "crisis," they were seen in the region of 72½. But with the settlement of an armistice between the Balkan allies and Turkey, with a brighter outlook regarding a settlement of the Austro-Servian difficulty, and the willingness for conference, there was an approach once more by Consols to the top prices of the year. Generally speaking, the request for money during the year was good. But during all the turmoil through which the Stock Markets have been passing, the Gas Market has expressed the confidence of investors by the slight (except in a few odd cases) retrograde movements that its stocks and shares have made. Several gas stocks and shares of home and foreign undertakings have receded one or two points during the year; but this is due to ruling conditions, and to outside views as to the effects of the coal strike and the higher prices now being commanded for coal, and not to any ability to gauge the position, properly and rationally, by viewing the conditions in their entirety. It may also be partly due to the tightness with which investors have held their gas stocks and shares. But, on the whole, the market has been in a sedent but firm position; and during the year transactions have been largely confined to comparatively few companies.

It is difficult, however, to account for some movements that have been made in gas stocks. Debenture and preference stocks have in cases suffered rather more than ordinary stocks and shares. But this again is significant of public confidence, as well as an indication of a desire to obtain higher returns on investments. The general percentage recession is from 1 to 3 on the year. Among the stocks that present rather more loss are Commercial and Portsea Island, and the heavy stocks of Brighton and Sheffield. A few of the home stocks show an accession of price. Among undertakings operating abroad, Continental Union and Oriental have both suffered, but the former recovered some of its flesh after the happy speech of the Chairman at the recent meeting of the proprietors. Imperial Continental made the most marked recession. But this is only temporary. Ottoman showed a good rise and maintained it, notwithstanding the war. Cape Town gas debenture and preference stocks further shrunk in price; but South African gas improved. In addition to the proofs afforded of public confidence by this record of almost infinitesimal backward movement (save in a few isolated cases) during the year, we have the fact that the loan of 8 millions which the Paris Municipality were authorized to raise for improving and extending the gas works and supply of the city was subscribed for more than 82 times over. Issues of stocks and shares by public auction have found ready buyers; but experiences in this connection are best told by Messrs. A. & W. Richards, who are in such close touch with transactions in this connection. They state that, as the "JOURNAL" columns have testified, they have, as usual, held periodical auctions throughout the year, at which many issues of new gas capital have been made, and the holdings of executors and other private owners disposed of. In the first half of the year, prices for ordinary stocks were well maintained, notwithstanding the disturbance caused by the coal strike. But, in the later months, the factors which have caused a shrinkage in values in all investment markets have to some extent had their influence on gas stocks; and prices have not compared quite so favourably with the earlier figures. It was not that Messrs. Richards lacked buyers, because, with one or two unimportant exceptions, everything offered was sold. But with unusually high yields obtainable in other directions, it was only natural that buyers of gas stocks should look for a correspondingly higher return. The firm add that debenture stocks, as well as preferences, have again shown a disposition to recede in value in sympathy with all stocks bearing a fixed and low rate of interest. But here again there have been plenty of buyers at the lower levels which have gradually been reached, and which, as far as our correspondents can see, look like prevailing for some time to come.

OUTSTANDING EVENTS IN THE YEAR'S HISTORY OF GAS SUPPLY.

The year has been marked by several events that have commercial or historical importance for the gas industry. There was the coal strike, which has had effect financially as well as upon the policy of gas administrations; there have been the celebrations of the centenary of statutory gas supply; the year also saw the commencement of the active work of the British Commercial Gas Association, which organization, there are striking indications, will make a deep impression upon the fortunes of the gas industry; further important steps were taken in transferring the standard quality of gas supply from illuminating power to calorific value; and there was the attack of the chemical manufacturers on the full exercise of the residuals products powers of gas undertakings. These last two matters will be referred

to again in the section of the retrospect dealing with parliamentary matters.

The Coal Strike and Effects.

Coal strikes have been often experienced before; but not in this country a coal strike such as the never-forgettable one of this year. The cloud was seen towards the end of the year 1911 in the demand for a minimum wage for each class of labour in the different coal areas; and by January the cloud had darkened. We need not discuss at length the question of the economic or the industrial correctness of the principle of a fixed minimum wage. Both in regard to labour and industry, it is unsound and indefensible, tending as it does not to the payment of individual merit and individual volume in output, but to payment irrespective of these qualities. The cloud developed; and by March the whole of the coal-pits of the country were silent. This was a national strike, and not the usual local strike with which there had formerly been acquaintance. It was also a national calamity. Labour (as was seen in the railway strike of 1911, and again in this coal strike) has given up the partial strike for the more drastic and far-reaching form. And beyond this, the extremists among the leaders are preaching the gospel of general trade and even international strikes, in order to force countries and communities to admit and to comply with the claims of any one section of unionist labour. Syndicalism too was largely talked of during the strike; as well as wild plans for making labour paramount in the world's affairs. These are all matters that have to be taken seriously into account when revising commercial policy. However, there was stubborn resistance on the part of both the miners' leaders and the coal owners against coming to any agreement over the minimum wage. The principle was conceded by the owners in the federated districts of the country; but the men's inflexible leaders at first held out for a minimum below which the minimum in any district should not go. The owners were not prepared for this. The Government then intervened; but even the Government could not bring about, either by intervention or intercession, an amicable agreement without having recourse to the passing of a measure through Parliament. So this was done.

The principle of a minimum wage for the whole of the coal areas was determined, and the machinery was provided for the appointment of joint district boards for the fixing of the minimum wages for the various classes of work in the different territories. The strike lasted a full six weeks; and then time elapsed before the whole country was again being regularly coal-fed. The difficulties of the time, the injury to the interests and the trade of the country, the crippling of transport dependent on coal in order to economize fuel, and the harm inflicted on the artizan and labouring sections of the community innocent of any lot or part in the originating trouble, will never escape the memory of those among us old enough to appreciate it all. The last-named phase of the strike was mirrored in smaller degree, and yet not less acutely within the East-end of London, during the strike of riverside workers—a strike that deservedly and miserably failed. [But that by the way.] When the joint district boards to fix the minimum wages for the miners got to work, and gave their decisions, there was in most areas discontent with the minima fixed, as they did not reach the figures the men's representatives had put forward, and which they had held out for. But nothing particular happened in consequence, excepting the prevalence of discontent, and an attempt to get the Government to intervene. But in October the miners' wages were raised 5 per cent.; and still another 5 per cent. was asked for at the beginning of this month.

As remarked, the strike lasted six weeks. It speaks well for the foresight and administrative ability in the gas industry that, with very few exceptions, the lengthy cessation of supplies saw no diminution in the supply of gas. In some cases, as much as a precautionary measure as otherwise, in view of uncertainty as to the length of the strike, there was curtailment of the hours of public lighting, or the number of lamps in lighting. Prevision and warning, however, had not brought all administrations up to the mark in stocking stores in order to meet such an emergency as this; while other undertakings had made sufficient provision for a strike of much longer duration. In certain cases, the contractors had got much behind with their deliveries, and nothing that could be done by gas managements could alter the condition of affairs. Further, the winter's demand for coal, and the rush for stocking purposes synchronizing, there was a congestion of traffic, and fault for short delivery was in consequence also laid at the doors of the railway companies. In other instances, too, seaborne coal suffered through the large demand for steamers, and the impossibility, in the rush for coal, of getting rapid loading. In all such cases, additional expense—heavy for some concerns—was incurred in purchasing in the open market. The South Metropolitan Gas Company purchased coal as far afield as Nova Scotia, America, and Germany, and the reserves of the Company were dipped into so far as legitimate to meet the extra cost. But the forced experiment proved the practicability of getting coal from abroad in times of strike—at a cost; freights being the money-absorbing factor. However, the prospect of extending the purchase markets for this country has been, owing to this experience, discussed more than once since the strike.

Though coal-stores had been sadly depleted by the time fresh supplies came in, the gas industry proved to the community generally that reliance could be placed upon it in such a time of difficulty and need. Its strength was tested and strained to the utmost; and it came through the ordeal with flying colours. Though there was a large demand for gas for domestic purposes during the strike—householders making greater use of gas in order to economize in their consumption of coal—the closing-down of industries through fuel starvation and the spirit of economy that quickly ruled through the land, caused on balance the increase in the consumption to be not above the normal rate. In most cases, too, though the demand for coke was heavy, gas undertakings did not raise their local retail prices; and thus they did a good part in ameliorating suffering among the poor. Those undertakings, too, with water-gas plants reserved a good proportion of their coke for the manufacture of additional quantities of water gas. Never perhaps has any gas undertaking with water-gas plant felt the advantage of its possession to such an extent as during this strike; and a water-gas plant will, in most cases, be looked upon in the future as an indispensable protection.

Speaking of protection, the character and length of the strike have raised the question as to the safe limits of coal storage. Faced by new labour conditions and policy, a fresh militant order of leaders, and a recognition by the labour unions of the futility of local strikes, large users of coal have almost universally come to the conclusion that their old rules for storage must be revised. In the gas industry, several engineers have advocated being ahead of requirements by two or three months of maximum consumption; while in the electrical industry there has been talk of from four to six months' supply to be in an absolute position of security. The larger margin of safety has also directed further attention to the question of the heating and spontaneous combustion of stored coal; and the revived study of this matter, as our columns have shown, has given a better grip of the causes that contribute to this unwelcome and destructive condition.

Arising out of the coal strike are a few other interesting matters. It has been found necessary to revise the strike clause in coal contracts. The Council of the Institution of Gas Engineers took the matter in hand, and recommended the form of clause they presented at the meeting of the Institution in June. The Miners' Federation of Great Britain have again raised the question of the nationalization of the coal mines, and of the means for distributing coal. Lastly, Sir William Ramsay has hinted at a tentative scheme he has been nursing in his mind as to turning coal mines into underground gas-producers, making gas direct from the unmined coal, and using it for driving engines at the pit head for the generation of electricity for general distribution. We called attention to the fact that Sir William had been preceded in the idea by one Anson G. Betts, who had taken out a patent in 1909 for the underground production of gas, but with the intention of distributing the gas. A coal owner offered to place at the disposal of Sir William a coal mine for the purpose of an experiment. Whether the offer has been taken up is not yet within public knowledge. However, the most important present result to the gas industry of the coal strike is the increase in the price of coal by 3s. to 3s. 6d., or thereabouts. The coal owners attribute this to the increased costs of production forced upon them by legislation; but it is as clear as anything can be that they have taken the fullest possible liberty to raise prices—not only current, but for forward contracts—on the demand created not by trade merely, but by the additional

demand occasioned by the replenishing of stores in consequence of the strike. Large users and constant customers have protested severely against the excessive opportunist move of the coal owners, more especially as, prior to the coal strike, the coal owners were doing exceedingly well through both the condition of trade and the provision that was being made by considerable users in anticipation of a coal strike. The increase in output in 1911 was no less than 7,458,871 tons, which made the output the greatest on record. A further point upon which the action of the coal owners has been condemned was made by Mr. Charles Carpenter in his address to the South Metropolitan shareholders in August. It was that he thought the Government ought to ensure that, after a coal strike such as the one experienced this year, the first supplies of coal available should be retained solely by this country, and not be allowed, as was the experience succeeding the strike this year, to be shipped in large quantities to other countries, while both steamers and railways waggons for the supply of home industry were standing empty and idle.

The Course of the Coal Market.

Just a cursory glance at the course of the coal market may be made here. The gathering clouds before the close of 1911 made purchasing large for stocking purposes; and this, combined with the fact that the winter demand was at its height, saw the New Year set in with markets strong and prices already high. But production, too, was on a high scale; and the miners are entitled to a recognition of the way in which they worked, notwithstanding the prospect of a severe storm. Durham reflects the conditions in other gas coal markets. The quotations there were, at the beginning of January, standing at about 12s. 6d. for bests, and between 11s. 6d. and 12s. for seconds. But as the prospects grew less bright regarding a settlement of the coal difficulty, and the demand still strengthened, the prices for bests quickly ran up to about 15s., and for seconds to between 13s. and 14s. When actual hostilities commenced, then famine prices ruled. All sorts of payments began to be made in the scramble for loose small quantities. During the early period of the strike, we heard of such figures as 25s. to 35s. per ton being paid, and that willingly; and for small stuff —rubbish almost—round about £1. Then the coal owners began to effect bargains for delivery, subject to the ending of the strike, at 16s. to 18s. per ton; compacts for early supplies were made even for seconds at about 17s. Then prices eased off between May and July, until between 13s. and 13s. 6d. were quoted for bests, and 11s. 6d. for seconds. Inquiries began to be made, market prices got firm, and contracts were entered into for delivery up to June next at prices in advance of those of the previous years, and those who waited longest had to pay the highest contract prices, until many gas undertakings have found their coal at 3s. to 3s. 6d. per ton higher than for the preceding year. September and October market quotations were still round about the figures obtained in the two preceding months; but the difference in price between bests and seconds had narrowed considerably. October and November and the beginning of December saw quotations for bests at about 15s. to 15s. 6d., and for seconds at 14s. to 14s. 6d. The rush for coal to replenish stores and the growing demand for winter gave the coal owners their opportunity. And they took it with both hands. What applies to Durham applies also to Yorkshire and other coal areas, making allowance for about normal differences in values. Market quotations for gas coke have been good throughout the year, although, as we have already said, several gas undertakings gave their localities the benefit of surplus coke supplies at normal prices. At the end of the year, market quotations are several shillings higher than last January—the rise having been in the North from about 15s. f.o.b. to nearly 24s. in June, but dependable quotations were not available in certain intervening months. A drop took place in the summer months; but October, November, and December have seen quotations between 21s. and 23s. 6d.

The Centenary of Gas Supply.

The next event which makes the year stand out with prominence for the gas industry is that it is the centenary year of the Gaslight and Coke Company, and therefore the centenary year of the birth of statutorily controlled gas supply. There is therefore a universal interest in the historic event. Upon the Gaslight and Coke Company and its Governor (Mr. Corbet Woodall) congratulations were poured from all parts of the world. The Company themselves celebrated the event in royal fashion—in manner indeed that showed to the world something of the vastness of the work and ramifications of the huge concern. Never will be forgotten by those of official rank in the Company, nor by the friends of the Company who were privileged to be present—friends in political, municipal, and industrial life—the banquet at the White City to which they were invited by the Governor and Directors. Never will be blotted from memory the festival of the rank-and-file of the Company, in their thousands, with wives or sweethearts, at the Crystal Palace. The spectacle on both occasions was extraordinary; but foremost in all that was remarkable was the demonstration these occasions afforded of the union and fealty of the whole body of workers for the Company from the Governor and Directors, General Manager, Chief Engineer, and Secretary, down to the humblest labourer. Succeeding the festival, the officers of the Company showed their affection for the Governor (who has done more for the Company, and those it serves and those who serve it, than any other man) by presenting him with his portrait in oils. In Philadelphia, our American friends also celebrated the centenary; and, by so doing, they evidenced, in warm-hearted manner, their ties with this country.

British Commercial Gas Association.

The third specially prominent feature of the year for the gas industry has been one that, with every confidence, many in the gas industry are anticipating will play a highly important part in its fortunes. Organized for the purposes of publicity and public educational work on matters appertaining to the commercial interests of the industry, and the conveniences and utilities of the daily life of the community, the Association has had another effect of equal importance, and that is it has set to work a new spirit in the industry, which is promoting and spreading day by day the view that there is a mutuality of interest in our industrial affairs that can be best fostered, and made still more durable, by co-operative work. The machinery of the new organization was in working order and all the officials appointed by the end of March. And in the work of perfecting the parts the ex-President of the Institution (Mr. R. G. Shadbolt), with Mr. F. W. Goodenough as the recognized and proper pivot in the executive mechanism, laboured vigorously and successfully. The *personnel* of the controlling bodies in the way of General and Executive Committees is a sufficient guarantee that the funds of the new organization will be disbursed with good effect; and from what has already been done in the few months that have elapsed, we hear of the public talking more of gas applications, making inquiries, and adopting new appliances. This is what is wanted—the cultivation of knowledge, of fresh requirement, and of a desire to secure the highest efficiency from the gas consumed. Therefrom issue maintenance and furtherance of industrial interests.

The Association has shown in its work much spirit and activity, which was recognized at the first annual meeting held in Manchester. Mr. Corbet Woodall, as the President (also as the head of the Institution of Gas Engineers and of the Society of British Gas Industries), had then the unique experience of presiding over a large meeting representing the varied sections and life of the industry. Municipal and company administrators, engineers, managers, and secretaries and gas plant and appliance manufacturers were all assembled there in a common bond of interest; and enthusiasm was at high-water mark throughout the business proceedings, and the accompanying social events. It was a complete triumph; and it augurs well for the future of the Association. The President's address was a very stimulating deliverance, and an appeal to all in the industry to take the highest possible view in utilizing their opportunities in serving the community. The papers read all ran on the lines of commercial development. An evening lecture by the ever-popular Professor Vivian B. Lewes, dealing with the "Hygienic Aspects of Lighting by Gas," carried instruction to many outside the pale of the organization. The report presented at the meeting by the Executive Committee showed how effective already has been the organization as an industrial agency, how large is its scope, and how considerable its potentialities if increased support is rendered to it. The Manchester City Council and the Salford Borough Council extended bountiful hospitality to the Association; and to them, and especially to the Lord Mayor of Manchester and the Mayor of Salford and to the respective Chairmen of the

Gas Committees of city and borough (Mr. William Kay and Alderman J. S. Phillips), there is great indebtedness for the magnificent send-off the organization had at the first annual meeting. In Germany, co-operative commercial work is expanding. In America, the subject has prominence, though there has not yet been success in formulating a definite co-operative advertising scheme. The gas men of France are now bringing commercial affairs more to the front in their deliberations. This is all good.

Exhibitions, Past and Prospective.

While talking of commercial propaganda, gas has also had very considerable publicity during the year through substantial exhibitions. Hardly an exhibition of any kind is now held—and very properly—without gas making in it an effective showing. It made a strong display at the Smoke Abatement Exhibition at the Agricultural Hall at the end of March and the beginning of April; the South Metropolitan Gas Company undertook, single-handed, a display *de luxe* at the Ideal Home Exhibition at Olympia; at Glasgow and Edinburgh there have been exhibitions of a striking and representative character; and at numerous other home exhibitions there have been sectional displays. At the Women's Exhibition in Berlin, a remarkable and unique display was made by our German friends, one of the features of which was reflected lighting by means of gas-lamps. At Amsterdam, there was an International Gas Exhibition organized by our Dutch friends; and this, too, was a brilliant success. During its run, representative men of the British, French, German, and Belgian gas industries were the guests of the Dutch Gas Association, who entertained them right royally. As being related to exhibitions on the larger scale, mention may be made of the continuing success of the South Metropolitan show-houses. From many gas-supply areas, there has come information of large and attractive showroom development.

But uppermost in thoughts at the present time is the National Gas Exhibition that is to be organized and held next year at Shepherd's Bush, in celebration of both the jubilee of the Institution of Gas Engineers and the opening year of the second century of statutory gas supply. The scheme for the exhibition, so far as delineated, is on novel lines. It is to be a large demonstration of the modern efficiencies of gas in its divers applications, and in settings that will appeal to the public inclination for novelty, and so will draw. The financing of this exhibition is also to be co-operative. Guarantees have been made by several gas undertakings; and there are more yet whose assistance will enable the scheme to be carried out in a manner that will be worthy the prosperous gas industry, and that will make proper representation of its power in serving the community and the country's industries. The Society of British Gas Industries have decided to do a good part in the provision of funds. But the number of their firms are few compared with the number of gas undertakings in the country; so that it is hoped that those of the latter who have not yet entered their names as subscribers to the funds of the exhibition will do so as quickly as possible, in order that—finance dominating the scheme—the plans may be completed early, and ample time be left for the detail work. Early next year, an international gas exhibition is to be held at Antwerp.

Gas Trading and Incidents of the Year.

From publicity campaign work to the commercial work of the year is a natural transition of thought. There is no need to go into detail; a general glance will suffice. The anxieties and troubles occasioned by the coal strike naturally diverted attention somewhat for a period from other matters—anxieties and difficulties that have been sufficiently touched upon. It was popularly thought that the cessation of coal supply would make a considerable difference in increased consumption of gas; but the strike really had the effect in many areas of creating temporarily abnormal conditions. The widespread effect on industry of the stoppage of coal supply, and the impossibility of suddenly converting for all factories the means of power and heat from solid to gaseous fuel, naturally led to the closing-down in the large industrial areas of numerous ordinary channels of gas consumption. In many other areas, while domestic consumption was generally good, there was almost a universal feeling that economy should prevail; and this, with (in some localities) a partial curtailment of the public lighting, made the half-year's consumption returns show about the normal rates of increase for these times—this applying, generally speaking, to London, to the suburbs, and to the provinces. But the second half of the year, when accounts are issued, should show considerable increases. Trade and the dull weather during the half year have been good for the gas business, and the boom in gas heating is having a fine effect on winter consumption. Reports have come from some districts of percentage increases in consumption that are unprecedented in them in modern times. This is highly gratifying.

The residuals markets have served the industry well. Coke naturally was in good demand in the first half of the year; while in the second half, the high price of coal has put up the market price. Sulphate of ammonia in most areas opened the year at over £14 per ton; and during the second quarter climbed up to figures that, in certain markets, were (at times) but little short of £15—in fact, in one market upwards of £15 was reached in April. July and August, however, saw a reaction. There was an improvement again by September; but since then there has been a little falling away, until market prices are about those with which the year opened. The market quotations for nitrate of soda, on the other hand, show an improvement on the initial prices of the year. The figures have been gradually moving up, until, from 10s. 1½d. to 10s. 4½d. per cwt. in the beginning of January, they stand just now at about 11s. 9d. to 11s. 10½d. There have been various appeals during the year to those producers of sulphate of ammonia who are not helping in the propaganda work of the Sulphate of Ammonia Committee to do so by subscription, inasmuch as to maintain the prices of sulphate, and create fresh demand, as well as extend the area of the Committee's operations to over-sea fields of commerce, it is imperatively necessary that they should be financed for this purpose. The levy per ton of sulphate, or on the total ammoniacal liquor produced, is very modest; and, as a charge against the present prices of the commodities, it is of an amount that ought to be paid without the slightest hesitation. Turning from fertilizers to tar, there have been the usual complaints during the year of the unreliability of published prices. Tar is one of the most difficult of the bye-products of gas manufacture for which to quote generally applicable figures. There are scarcely two neighbouring undertakings the tar from which is of equal quality and worth equal prices. We have seen, on the quality basis of purchase, qualitative variation make a difference of several shillings per ton in the value of the product of neighbouring concerns. However, while here we will not mention figures, tar has been doing extremely well during the year. The demand for road purposes has made an immense difference in values; and tar is to-day fetching several shillings more per ton than at the opening of the year. Right away from May last excellent figures have been obtained, though they have shown a slight tendency to backward movement in the few closing weeks of the year. The prospective outlets for secondary products are beet growing for sulphate of ammonia and motor driving for benzol. This is a suitable place to acknowledge the continued excellent work of the Commercial Sections of the District Associations.

In the circumstances, although the price of coal has been higher, and the "cost of living" generally for gas undertakings has increased—additional necessary expenditure in the distribution department and for labour (partly brought about by legislation), and the enhanced cost of appliances of all kinds through the higher prices of metal and the increased expenses falling upon the producers of the appliances, together with accessions to rates and taxes—the financial results of the year promise to come out exceedingly well, and show flourishing and expanding conditions. This applies to municipal and company undertakings alike, both at home and abroad. Even at the Cape, which in gas affairs has been under a cloud for a period, there are signs of a revival—indeed it may be said that the revival has already set in there, and the gas undertakings are beginning to retrace their steps. While speaking of affairs abroad, reference may be made to the attempt in New South Wales to force upon certain undertakings there legislation in regard to price and dividend that would have meant robbery, and nothing else. But the Act that the Legislature eventually passed approached much nearer to justice than the original proposals. An inquiry was also made into the affairs of the Metropolitan of Melbourne Gas Company, and recommendations of a somewhat drastic order were made to the Legislature, which, if enforced, would also make a considerable difference to the holders of the Company's stock. However, everywhere the conditions of the industry are such

that its prospects are of the brightest so far as business is concerned; its drawbacks are of the externally imposed order. This, the best of administrations cannot avoid; they can only work to modify the weight of the incidence of these heavier external adverse factors. There are a few minor concerns that are under a cloud of depression. They are the flotations of those promoting parasites that fasten on affluent and well-conditioned industries. There have been spasmodic attempts to do a little more of this sort of disreputable work during the year; and attempts have been made to unload practically worthless shares, by alluring methods, on lady gas shareholders. But we are pleased to know that the attempts have met with little success. The Law Courts have also been engaged with their affairs again during the year.

Just a few lines specially as to the conduct of municipal trading undertakings. A matter of perennial interest is that of the policy of taking profits from municipal trading concerns and handing them over to alleviate the rates. Our own attitude towards this policy is known to be one of absolute antagonism. In the course of the year, there has been extensive discussion in municipal circles regarding this blot on local polity. It may be said that, if anything, there is a growing feeling against the continuance of the system; but those councillors in favour of profit appropriation still (by numbers, not by the soundness of their case) control the position. The members who immediately discharge the work of administering the trading undertakings are generally found to be hostile to the profits made being appropriated for purposes other than to enable their concern to give the best and cheapest service to the community. Their executive officers are in the same boat. Manchester is an outstanding example; but all the anti-profit-appropriators can do will not bring the pro-profit-appropriators to see things from any but their own narrow standpoint. In the case of Salford, the principle of profit limitation had to be accepted by the Corporation. The force of circumstances was too strong for them to offer further resistance; and now, under their Provisional Order of the year, they will have in future to be content with a fixed sum from the gas profits for the purpose of relieving the rates. The extraction of profits from the trading undertakings of municipal authorities has gone to such an extent as to be a positive scandal; and the spasmodic attention that Parliament has given to the subject will now, it is hoped, take a more definite and effective form. The Sheffield Corporation have been in a dilemma over their electric wiring and hiring department. The Courts have declared that they are acting *ultra vires* in carrying on the department; and an appeal is pending. The House of Lords also modified clauses in the Corporation Bill that were intended to ratify the existence of the wiring and hiring department. The House of Commons, however, restored the clauses to their original form.

There were one or two minor breaks in the excellent reputation of the gas industry for permanence of supply—a reputation that is the antithesis of that of the electrical industry. Stalybridge suffered for the best part of two nights and days by the withdrawal of its gas supply, owing to a strike of municipal employees. There was a short cessation (which was promptly remedied) at Otley; and owing to the disturbance of some mains through street improvements, Beeston (near Nottingham) suffered temporary and partial trouble. The floods in the summer in part of the Eastern Counties resulted in the electricity supply of Norwich being cut off; but the energetic and persistent measures taken by Mr. Thomas Glover, and his loyal staff and men, maintained the gas supply to the city throughout the terrible ordeal.

Opportunity and Vitality.

No part of the gas industry where there is administration that takes into consideration the mutations of our internal industrial life and circumstance can fail to reap advantage from the present position of affairs. The evidence is constantly presented that advantage is being taken of the new conditions contributing to prosperity. The Board of Trade returns issued last January showed that in 1910 for statutory companies, and in 1910-11 for municipal undertakings, the revenue had increased by nearly a million sterling. They disclosed increased trade connections. They indicated, too, that, in profitable product per ton of coal carbonized, the industry is working to realize the maximum yield of gas; for the whole of the statutory gas undertakings in the year named the average make was 11,383 cubic feet per ton of coal—the highest average ever reached. This, however, being the average, many undertakings have to make greater headway yet where the quality of coal will allow, seeing that several concerns are now producing more than 12,000 cubic feet per ton, and certain are boasting of 13,000 cubic feet or thereabouts—in some cases, without disclosing the percentage content of inert gas! On the works, too, effort is proceeding to improve the quality of coke, to lower the fuel account, to enhance the make of sulphate per ton, and to raise the quality of the tar, which is contributed to by the adoption of the new processes or methods of carbonization. These are the days in which search has to be made on the works for small economies and for additional profits by operating in every branch towards the realization of the highest standards that have been anywhere set by achievement. Competition and increased costs have made this compulsory.

Irrespective of the excellence of the residuals trade, the position of the gas business is highly encouraging. The year has accentuated this encouragement more than ever. If the whole history of gas supply is investigated, it is found that there has never before been such a combination of circumstances as now that spells strength in relation to business progress. The policy of co-operative effort is spreading; its influences are being everywhere felt. Gas, through its growing cheapness and its higher efficiency appliances, appeals to all classes of the community. The base of business is constantly broadening—not only in the range of consumers, but in the range of applications and heightened efficiency. Consumption, too, has a tendency to increase more during the daylight hours than during the hours of darkness. An investigation of the hours during which the greatest expansion of business has been taking place in Manchester shows that the increase is marked in manifold manner between 6 a.m. and 2 p.m., while the consumption increase in the two other eight-hour periods of the day goes on in much the same ratio as formerly. Birmingham, too, has been making an investigation into its increases over a number of years; and expansion is found in all departments—prepayment meter, lighting and domestic, and manufacture and motive power. The only falling off in consumption is in public lighting; and this is due in Birmingham solely to the adoption of higher-efficiency street-lamps. Excellent testimony is all this to vitality. But we may go farther afield for illustration such as we cannot obtain in our own country. Working on the concession principle, the Imperial Continental and the Danish Gas Companies have occasionally had whole towns passing from their possession into the hands of the municipalities. But the vitality of the gas business is such that, in these days, the remaining stations—true with the spread of the distribution feeders to small communes adjacent to the main area of supply—soon build up compensating increases. Only in 1911, the part of the Vienna district that had been served by the Imperial Continental Gas Association passed over to the Municipality; but at the meeting of the proprietors of the Association in November this year, the Chairman (Mr. J. Horsley Palmer) informed them that, up to the end of September, the increase at the other stations of the Association had been such that only another 10 per cent. increase was required to make the present aggregate volume of gas business counterbalance that preceding the loss of Vienna. In the paper that Mr. H. Townsend read at the Institution meeting, he gave some remarkably interesting information regarding consumption and the changed conditions in regard to the day-period of demand.

These satisfactory features are all well in mind with most gas administrators, though there are still places on the map where marks could be made to denote archaic administration—not so much on the part of executive officers as on the part of those who have the final voice in administration. However, notwithstanding the higher price of coal, and the enhanced prices of other material, the year has seen many good reductions in the price of gas; but we are afraid the current conditions will not for a space allow the same evidences of a forward policy in this direction. Meanwhile, there is much work to be done in other directions. Public knowledge as to the efficiencies of gas appliances is spreading; and so is information as to the hygienic advantages of gas as a lighting and heating agent in comparison with other means of supplying the needs. But still the year has shown that the methods of propagating this knowledge require to be constantly on the move. There is considerably more work, too, to be done in the houses of the poor. Mr. Corbet Woodall made reference to this at the meeting of the British

Commercial Gas Association. He is convinced that more can be accomplished in the improvement of the homes and health conditions of the poor by better lighting, heating, and cooking. This particularly appealed to the municipal representatives of the densely populated regions of the North, who have, more than ever in these days, the perpetual call for improved sanitation, as a social necessity, of the dwellings of the poor and of the atmosphere of cities and towns. The Society of Medical Officers of Health, too, showed, through demonstrations and lectures, how health was undermined and disease fostered by the indifferent cooking arrangements in the houses of the very poor. They not only want proper means for cooking, but they want to be educated to their right use. There is no lack of work for the gas industry to do, beneficial to themselves and to the communities that their statutory powers give them the right and privilege of serving.

Lighting, Heating, and Power.

The enhanced efficiency of modern gas appliances and the facilities afforded for their adoption by gas undertakings are two of the ways of expansion. The year has seen more developments in both respects. Facilities for hiring and maintenance have continued to be applied; and additional gas undertakings have gone to the length of adopting the policy of a free supply of cookers and fixing—Glasgow and Edinburgh for example. In technical discussions, too, the importance of maintaining a gas supply of approximately uniform composition, specific gravity, calorific value, and pressure have had additional consideration; and this consideration has ended in improved practices. With higher pressures, too, necessitated by the diverse uses of gas, the utility of the service governor still continues to receive attention; and there is extended application. Recent discussion has shown that these governors are particularly serviceable where the pressure-wave system of lighting and extinguishing public gas-lamps is in force, though their manifold advantages to private consumers do not allow it to be suggested that they are, with no other attending benefits, an indispensable auxiliary of the system. There are, in fact, districts in which the pressure wave system is applied without the use of consumers' service governors, and complaint is rarely heard from them.

In lighting appliances, there are no startling improvements to be chronicled this year. Burners and lamps continue to be improved in detail; and the makers are constantly adding to the range of their goods for domestic, for large interior, and for public lighting. The same with fittings and glassware. The inverted burner is to-day generally applied in new and improvement schemes on the large and the small scale. Low-pressure high-power lamps have been receiving special attention; and new forms have been introduced in the course of the year. Ventilating lamps, with inverted burners, are coming into increasing favour for halls and so forth; special improvements having been effected in this direction. Between high-pressure gas systems there is keen competition to-day. The makers never cease in their efforts to effect detail improvements; and the modest compressing plant now required for isolated installations where high-pressure mains do not exist, is noteworthy. The system is making remarkable progress in this country and abroad for parade and shop lighting generally, factory and large space lighting, and street lighting. In many instances at home electric lamps have had to make way for high-pressure gas-lamps. The gas undertaking that has not to-day its high-pressure demonstration on a small scale, if it has not the opportunity for a large plant, is behind the times. In connection with high-pressure street lighting, additional experience has developed effective central suspension equipment with raising and lowering gear. The same with standard lamps—good workable gearing for raising and lowering is available, and has stood long tests. Several papers have been read on the subject of high-pressure lighting during the year; and an excellent report emanated from Glasgow (where a large street lighting trial is now being made with various types of lamps) on a visit of inspection of street-lighting on the system to cities in this country and on the Continent. Professor F. W. Burstall is delivering a series of lectures on high-pressure gas to the Midland Junior Gas Association. Reference has already been made to shop lighting; and in this connection, the improved gas flash-signs, it may be mentioned, are making good headway.

In relation to public lighting, the tendency of most local authorities is towards improvement; and the gas industry can effect improvement, it has been demonstrated during the year, at lower capital and running costs (where competition is on commercial lines), and give a better distribution and quality of light, than the electrical competitor—either with large or small units. Competition is now very keen for public lighting; the electrical people finding that they are losing prestige by the favour and successes of modern gas lighting. Where there is level competition (where there is not undue consideration shown to a municipal electricity concern and disfavour to a company gas concern) gas wins if the gas administration is enterprising. Level competition this year has brought victory to gas at (among other places) Bournemouth, Doncaster, Guildford, and Newmarket. The Westminster gas illumination contract continues to give a good account of itself—both the high and low pressure inverted gas-lamps showing a higher illumination at a less cost than either flame arc lamps or metallic filament lamps. The carrying through of the equipment of the City of London under the contract for gas and electric lighting (under which standards are as far as possible now being replaced by central and bracket suspension) is making good progress. The joint scheme in Holborn has been completed, and the gas-lamps are giving a good account of themselves and every satisfaction.

At the opening of the year, indignation was displayed by ratepayers of Hampstead over an expenditure of £10,000 in excess of the estimates for the conversion of the public lamps of the district from gas to electricity, and the lower illumination efficiency that the change had effected. This experience did not assist elsewhere the case of municipal enthusiasts for conversion. A notable event of the year in connection with public lighting has been the Manchester trial with high-pressure gas-lamps and electric flame arcs, with the reports thereon of Messrs. Jacques Abady and Haydn Harrison. Everything was done to make the arc lamps give the highest possible photometrical readings, even to the adoption of plain globes with the outer ones only slightly obscured at the bottom, as well as the employment of large diameter reflectors. The character of the light in respect of glare and distribution was harsh and indifferent; and the general quality of the lighting was much inferior to that of the high-pressure lamps. But an important fact was made plain by the tests. The high-pressure lamps, owing to faulty equipment (locally carried out) between lamps and compressor, were not receiving gas at the proper pressure, and were only developing 27 candles per cubic foot of gas supplied. Yet, though the candle power of the lamps was much lower than that of the flame arcs, the illumination at the testing-levels from the former was practically the same as that from the latter. The street-lighting specification upon which the Institutions of Gas and Electrical Engineers and the Illuminating Engineering Society have been in concert endeavouring to formulate has not yet been issued; but indications as to its lines were presented in the annual report of the Institution of Gas Engineers, and were discussed at the June meeting. Progress has been made in the lighting and extinguishing of public lamps by the pressure-wave and mechanical systems; and the employment of Hertzian waves for the purpose has been the subject of a patent by a French firm.

Reverting to indoor applications of gas, the boom in the utilization of gas for heating continues; and there seems little doubt that we are on the verge of considerable developments in this direction. The gas-fire makers are alive to this, and are sparing no effort in effecting improvements in their appliances, and enlarging their range and the conveniences of maintenance *in situ*. They have also extended their patterns so as to make gas-fires suitable to any situation—in the rooms of the most palatial mansion, in those of humble dwellings, and in all descriptions of property lying between. The convenience and labour-saving attributes of gas-fires, as well as their heating efficiency, are obtaining a large hold of the public; and the fact that they supply the most controllable source of heat is being widely acknowledged in a healthy way. Their effect in promoting a sanitary atmosphere is also receiving growing appreciation, as witness the speeches made at the Smoke Abatement Conference at the Agricultural Hall. The principles of fire construction have been very vigorously discussed during the year; and in connection therewith is associated the question of hygienic efficiency. The discussion of this matter was further raised over the Shadowgraph method of testing gas-fires, in connection with which Mr. W. J. A. Butterfield made a thorough inves-

tigation into the principles underlying this test, chemically checked his findings, and pronounced the complete reliability of the test as a means of quickly detecting any escape of the products of combustion from beneath the canopy of a fire. The taxi-meter has come into use as a means of popularizing gas-fires for bed and private sitting-rooms in hotels, pensions, and clubs. While on the subject of heating, it may be mentioned that there has been a partial lull in the attack on the use of radiators for heating large interiors. This is due to the supplanting of ignorance by knowledge as to the proportion of carbon dioxide in the atmosphere to which the human system is indifferent, and to the spreading view that it is not the radiator but ventilation that is mainly at fault if the chemical composition of the atmosphere becomes of a character that is not good for human respiration.

There has not been much change in the construction of cookers during the year; but new forms are the Potterton cooker, in which the gas-jets are removed from the interior of the oven, and the large hotel range as fixed at the Langham Hotel, in which the ovens are all externally heated. The claims of electric-cookers led to some discussion during the year as to the methods of employing gas-ovens; and the use of enclosed ventilated baking-tins, casseroles, &c., claimed additional consideration and application. The question of utilizing the waste heat of gas-ovens has also been looked into; and inventors are busy devising a method of heating water, for kitchen use, by means of the heat of the oven while cooking is in progress.

Water heating, through circulating systems, by boilers and geysers is a field of gas application that is being sedulously cultivated by some undertakings, while others are, curiously, not paying much attention to this profitable line. But a considerable amount of work has been done; and the character of the demands and the views of makers on the subject are attested by the attention that has been devoted, and is still being devoted, to the devising and placing upon the market of new appliances. The keenness, too, that is being evinced in the matter of efficiencies is extremely satisfactory.

The same in industrial heating. Low-pressure furnaces have been developed that have a large range of temperature; but for the higher temperatures—say, above 1000° or 1200° C.—high-pressure gas has a large balance of expert favour on its side, though, on the other hand, there are important users of gaseous heating who give preference to the air-blast with low-pressure gas.

A number of extensions have been made in the applications of the surface combustion method of heating with which the names of Dr. W. A. Bone, Mr. C. D. M'Court, and Mr. James W. Wilson are associated. The remarkable efficiency of the system for steam-raising, under which some 90 per cent. of the net heat of combustion is transferred to the water, continues to be demonstrated in daily practice. Publication has been made in the course of the year of results obtained in various other applications—such as furnace work, and in water heating.

Many references have been made in technical discussion and literature to the use of gas for power purposes; and in this connection a valuable series of lectures was delivered by Professor Burstall. In these days of competition, the necessity of proper periodical inspection and adjustment, in order to maintain the working efficiency of engines, has been insisted upon. Not much progress has been made with the gas-turbine; and Dr. Dugald Clerk and others have said very candidly that there is little chance for the gas-turbine, unless a new line of construction can be discovered, or new material can be unearthed which will stand the temperatures and the strains. The Diesel oil-engine has been largely exploited during the year; but it appears to have received greatest adoption among the competitors of gas—that is to say, at electric generating-stations. More has been learnt, however, as to running costs—fuel costs only forming a fraction of the total, and these costs subject to the vagaries of the oil market. The first cost of such engines, too, is heavy, owing to the weight of material that has to be put into them to stand the strains. There have been two or three serious accidents with them in the course of the year.

Two miscellaneous matters that have occupied attention, and which properly come into this section of the review, are the training of gas-fitters and the additional price for gas-stoves. A scheme of educational work for gas-fitters has been finally formulated—thanks to the Commercial Sections and the District Gas Associations, in collaboration with the Institution of Gas Engineers. The Manchester District Institution deserve credit for their initial work in this important and essential matter. The agreed scheme was discussed at the meeting of the Central Institution in June. Regarding the price of gas-stoves, there was some discontent over the second addition to price made by manufacturers. In the first place, a 10 per cent. increase was imposed; and after the coal strike, in consequence of the advanced prices of materials and the increased charges for labour, a further 5 per cent. was deemed fair and necessary. Of course, the makers of gas-heating appliances have no difficulty in showing that they are not immune, any more than those engaged in other lines of industry, from the inflictions of modern labour movements and trade conditions.

Illumination.

Illumination topics have been prominently under notice. A greater amount of consideration is to-day being devoted to the quality and effects of artificial illumination, and to the proper application of light, than was the case a few years since. The study and science of these matters are being fostered and pushed very much to the front by the Illuminating Engineering Society of this country, and by the American Society. A similar Society has now been started in Germany; and in France and Austria there are many independent scientists working on the various branches of the subject. We are convinced sufficient attention is not being devoted to these subjects by the gas industry of this country, and that it is not taking a sufficient part in the movements in this connection. A proposal is on the *tapis* for the appointment of an International Commission on Illumination; but it has not yet made much headway. However, with three Societies organized to discuss and investigate and to urge action in the rational application of light, such an International Commission is brought nearer to a practical consummation. Governmental authorities we have seen during the year are also looking into the subject. In the report of the Chief Inspector of Factories this year, there was a valuable statement regarding an investigation made by Mr. D. R. Wilson into the present lighting of factories; and throughout it was very suggestive. It is also known that the Government are proposing to appoint a Committee to consider the subject. From New York State, there comes intelligence of proposed legislation referring to factory lighting. In the annual factory report already referred to, there was less to complain of on this occasion as to the attitude of some district inspectors towards gas lighting, and greater impartiality was evinced. Knowledge is spreading, to the manifest advantage of gas. But there should be a monitory word. The gas industry must see that its interests are properly represented, and not lost sight of by the overshadowing prominence of electrical partizans in this work of scientific illumination.

It has been our endeavour to keep well to the fore the fact that gas lighting has much in its favour over electric lighting. Hygienically, it is superior. In the composition of the light, in the matter of intrinsic brilliancy, and in regard to the ability to properly judge colours by its aid, it is, in the incandescent form, the superior of electric lighting; it has besides a higher diffusive and distributing power—as proved (to give two examples only) by the street-lighting tests at Manchester and those in Holborn. To the matter of colour judging by artificial lights and their relative fitness, more than once in the course of the year attention was directed. For this purpose "artificial daylight"—that is an illumination which from the hygienic and physical standpoint is as nearly as possible the equivalent of sunlight—is the essential. On our invitation, Mr. Thorne Baker, an authority on this subject, contributed to our columns an article dealing with it. His opinion is that artificial incandescent gas-light particularly lends itself to the production of artificial daylight. The possibility is suggested of using impregnating material for the mantles so as to bring the spectrum of the light to the equivalent of daylight, without requiring the use of filter-screens, as is the case with other forms of artificial light. As it is, the spectrum of incandescent gas-lights—particularly high-pressure lights—approaches as near the spectrum of sunlight as any commercial artificial light. There has also been much discussion during the year as to the methods of neutralizing the sight-impairing effects of electric lamps; and the various systems of doing this have been discussed—the semi-direct (prismatic or such like globes under the lamps), the semi-indirect (translucent

globes under the lamps with also reflection from the ceiling) and the indirect with reflection solely from the ceiling. The last-named has so many inherent defects that it is not receiving the favour from illumination experts that its commercial advocates could desire; and, on the part of users, the original attraction of novelty soon gives place in many cases to an utter dislike of the system, as witness more especially the Lecture Theatre of the Institution of Electrical Engineers. In the matter of light distribution, some further polar curves have been published, showing the excellence of gas-lamps in this respect, as well as the importance of properly designed reflectors for a given class of work.

Constructional Work.

The questions with which we have been dealing affect the commercial side of the industry; and they have been invested with an importance in the welfare of the industry which makes consideration of them a matter of essential and persistent care. We must, however, turn from them now, and glance—it must necessarily be quite cursorily—at the more prominent matters identified with works and plant that have claimed attention during the year. Their variety is large and comprehensive. A greater spirit of study of every process is evident; and this is good for progress, and the realization of higher efficiencies. Works' extensions have had representation in several descriptive articles from home and foreign sources. It is more than ever essential to-day to make a wide survey, as types of plant—especially carbonizing—and engineering ideas are separating themselves farther than ever from the older and closely stereotyped forms. The range of plant of all kinds is such that careful discrimination has to be made of the conditions under which it has to be applied.

In carbonizing plant this is so. We see gas engineers of recognized position the world over adopting the different intermittent and continuous vertical systems, while others still pin their faith and the reputation of their working results to the horizontal system operated under the modern conditions of heavier charges. There has been a considerable adoption of the various vertical systems in the gas-works of this country—the continuous system taking the lead here, though the intermittent has also made a fresh start in application. There is no need to catalogue specifically the types of plant and the places of their adoption. An interesting event of the year was the amicable settlement of the litigation threatened between the owners of the Dessau patents and of the Glover-West system. The objections that were at one time raised to large oven plant for gas-works purposes have been considerably modified by experience and improvement; and in this country an installation of the Koppers coke-ovens has been made at the Saltley works of the Birmingham Corporation. The adoption there is entirely a commercial one; the inducement being the field that there is in the city and suburbs for the sale of metallurgical coke. We have given this year descriptions of this particular form of plant as installed at other gas-works abroad—notably at Vienna; and reference was made to the largest installation in the world, put down by the Indiana Steel Company—its carbonizing capacity being, in eight batteries of 70 ovens each, no less than 9500 net tons. In the Vienna installation, the Kerpeley gas-producer has been applied; and this has aroused considerable interest. A description of this plant has also appeared in our pages. The Klönne chamber ovens are also making headway abroad. Not much progress has been effected in this country in utilizing for town-supply purposes the gas from coke-oven plants, although Middlesbrough was talking of it, and a visit was paid to Essen by a deputation of the Corporation, including the Gas Engineer, to see what was being done there. But nothing further has transpired in regard to the scheme. In Germany, however, the supply of coke-oven gas to towns continues to progress, and additional information has been published as to the transmission of the gas over quite long distances. Under a syndicate with the title of Eticoal, a strong attempt is being made to place the coalite system of low-temperature carbonization in a commercial position. More rational views now prevail; and the high flights of imagination of those who first tried to exploit the system have to-day been superseded by more practical, technical, and commercial ideas. In retort-house equipment, conveying plant has not had much attention bestowed upon it in technical discussion this year, excepting in connection with the telpher system of transport, which has secured, and continues to receive, a very large amount of favour. A mechanical furnace charger has also claimed attention—description of it being given at the last meeting of the Southern Association. The details of the retort-house we must pass over, though they have in technical meetings received a good share of attention.

Of the other plant on gas-works, gasholder constructional work has received quite a spurt in consideration. There are various causes for this. Probably first place should be given to the collapse of the spiral-guided holder at Ilkeston, through the bursting of the steel tank. Owing to the flooding occasioned by this, the life of one young servant girl was sacrificed. The accident was the subject of full inquiry, as the good reputation of the spiral-guided system over many years, and in many situations in all parts of the world, invested this solitary serious mishap with something of mystery. Engineers were called to investigate the causes of the accident; and experts contributed in our columns their views on the subject. At the inquest on the body of the one victim by drowning, a close investigation was made. But this was not deemed sufficient; and an inquiry was instituted by the Home Office, which was presided over by Mr. A. G. Drury, one of the Engineering Inspectors of the Local Government Board. His report has not so far been published; but a point that received marked emphasis from various quarters at the inquiry was the close cutting down, through keen competition, of the factor of safety, so that the margin in this tank was not, in the opinion of some experts, quite so high as it should have been in order to give complete assurance of security. Yet the fact remains that there are other spiral-guided holders that have been working, and standing stable, in which the factor of safety in the several vital parts is precisely the same. Whatever the character of Mr. Drury's report may be, there will in future constructions be a greater breadth of view taken regarding this point. But this one accident is not a condemnation of the spiral-guided system; and no engineer, with all the experience spread before him in this country and others in all circumstances, would have it so. At Oldham, the largest spiral-guided holder in this country is on the verge of completion; and the largest holder of this type south of the Equator—a 4½ million cubic feet one—has been finished at Buenos Ayres. Notices have also been published of smaller examples. Of column-guided holders, the largest brought into use in the course of the year is the 10 million cubic feet one at the Bradford Road works of the Manchester Corporation; this being the second largest holder in this country. In the whole world, our mammoth holders are only exceeded by the new holders of the Consolidated Gas Company of New York. America has given us considerable contributions during the year on gasholder and tank construction.

While speaking of gas-works plant, it may be mentioned that a committee of representative gas companies successfully negotiated with the Inland Revenue authorities for a settlement of the vexed question of depreciation allowance in respect of income-tax. This refers both to plant and to the distribution system and appliances; so that it is a little difficult to assign it proper position in a review of this description. The scheme (which evidences in its details the display of diplomacy on both sides) was, as finally adjusted, published in our issue for Sept. 24.

Among the Processes of Manufacture.

Methods of operation have been discussed in the course of the year even more than constructional work, though the latter has received a fair share of attention. But the ground covered is so spacious that a volume would be required to indicate only the nature of the work and the findings of the examination that has been given to the various subjects. Reverting to carbonization, at the beginning of the year, technical consideration was still being given to the clever series of Cantor Lectures by Professor Vivian B. Lewes, which he concluded with his favourite advice to practise lower temperature carbonization, and leave a larger amount of volatile matter in the coke, sacrifice the end make of about 3000 cubic feet, and then dilute the gas with 4000 or 5000 cubic feet of blue water gas. We have not heard of any gas maker who has as yet discovered that it would be to his commercial advantage to work in this way. There has also been the classical series of investigations carried out by Dr. W. B. Davidson with Dessau and horizontal retorts, to ascertain the relative positions of the systems from the scientific and commercial points of view. The matters covered by these investigations are too extensive to permit

of any but brief notice in a rapid review of this character. But Dr. Davidson, it may be said, would have the production of both gas and residuals from the coal carbonized so arranged as to yield the largest possible profit. In this connection, he objects to the cracking-up of the tar vapours, in order to increase the quantity of gas, and thus, while at its present price, make sacrifice of both quantity and quality of the tar. Dr. H. G. Colman has challenged (and he is strongly supported) the theory as to the travel of gas in vertical retorts through the cool central portion of the charge. His chemical tests confirm his view. We have had furnace and heat control discussed, and the important question of fuel economy. Contributions to the question of the life of vertical retorts have been made by Dr. Bueb and Mr. E. Körting. Dr. Bueb submitted that Dessau vertical retorts might be allotted a working life of 25 years. Mr. Körting stated that at the time of writing, the oldest vertical-retort settings at Mariendorf had had a run of 1600 days without repair; and he hoped that they would continue another 2000 days without needing any. Reckoning an average working year of 200 days, this life would represent 18 years. There was a further report at the Institution meeting from the Refractory Materials Committee. There are those who wish the Committee had gone to a higher standard for fire-clay materials; but it is no part of the work of the Committee to legislate for abnormal conditions. At the recent meeting of the Society of British Gas Industries, Mr. G. H. Pearson-Perry stated the position of the makers of fire-clay goods, and held that, with all the additional work to which they were now exposed, they should receive some compensation in the way of a more remunerative price.

Purification stands a good second to carbonization in the amount of attention bestowed during the year; and the subject possesses a large degree of interest just now in view of the new processes that have been evolved, certain of which processes are aiming rather at a greater degree of purity, and a lessening of labour and nuisance, than at any reduction of cost. These are things worth working for, and their attainment is worth some additional expense; for certainly no new process can ever hope to attain much, if anything, in the way of bringing the costs below those of oxide purification. We agree, however, with those who hold that a high degree of purity is far more important than any modest saving. Ordinary systems of purification have been in the course of the year discussed in papers; and experiences have been given as to the realization of economies by changes in the details of practice. We have heard more too as to purification by ammonia in closed vessels; and the Holmes plant has been introduced to technical notice. Attention was also directed from America to the question of continuous gas purification with weak ammoniacal liquor. The Burkheiser process, the Paterson coal-liming system, and the question of the air revivification of lime, have all received consideration. But the process upon which gas men have their eyes, but about which they have as yet had little information except that gained from the patent specifications, is the system already in large use at the South Metropolitan Gas-Works, and which Mr. Charles Carpenter hopes will be applied to the whole of the Company's gas some time during the coming year. This fact proclaims practical success. It is a system in which the bisulphide of carbon of preheated crude gas is converted into sulphuretted hydrogen by contact with heated surfaces; the sulphuretted hydrogen being removed in the oxide purifiers in the usual way. In the last annual report of the Chief Inspector of Factories and Workshops, Mr. W. S. Smith (Inspector of Dangerous Trades) again referred to the accidents there have been in connection with the emptying of purifiers. He finds that gas-works' conditions are generally being improved; but he still points out that there are works in which the conditions and locality of the purifying plant may possibly contribute to trouble. The results of an investigation into the causes of the "souring" of oxide were included in the report of the Chief Inspector of Alkali Works, Mr. W. S. Curphey.

If purification stands in point of consideration during the year a good second to carbonization, then ammonia recovery makes an excellent third. Several times the matter of direct recovery has been introduced; but in the application of direct recovery, gas-works are not keen upon taking it up, owing to the depreciating influence of contact with sulphuric acid on the illuminating constituents of gas. But it is the system favoured by the owners of many coke-ovens; and it is going to be urged more and more on the attention of the technical advisers of gas undertakings. Under the system there is a saving in the storage of the ammoniacal liquor, and a reduction of the effluent resulting from sulphate of ammonia manufacture. The point as to the make of sulphate of ammonia per ton is also one that has been prominent. There is great disparity between the makes of gas undertakings, in which the conditions of working suggest that there ought to be an approximation of result. But the accounts do not show this to be so; and there is a reason that needs investigation. No doubt more careful attention to the details of working would reduce the difference. Some of the smaller works, where the circumstances of operation do not permit of such high makes of sulphate per ton, are in cases finding that they can effect profitable improvement in result by paying closer attention to detail. At the meeting of the Royal Sanitary Institute, the question of the pollution of streams by the effluents from sulphate of ammonia plants was made a prominent matter for consideration. In cyanogen recovery, Mr. P. E. Williams has patented a simplified process, in which the work is transferred from the washers to a special form of purifier-box. This was described by Mr. A. E. Broadberry at the meeting of the Eastern Counties Association in September. Also noticed has been a French process for the simultaneous extraction of sulphur and cyanides. In connection with tar, the experimental gas station at Michigan has furnished some interesting information as to the electrical treatment of gas for tar removal. The indications are that the electrical method offers greater efficiency in less space than does the ordinary system of treatment. But more information is wanted—particularly as to cost. Coke (last mentioned, but most important residual) does not call for any extensive reference. The method of cooling coke in the base of continuous vertical retorts, giving as it does a coke free from the depreciation effected by water-quenching in the ordinary way, is looked upon with much favour. There has been increased attention paid to the question of how to improve coke for sale by reducing the moisture content and the amount of ill-treatment to which it is often subjected; and, in connection with the telpher system of transport, quenching improvements have been effected. Less is heard to-day of the naphthalene trouble; and there has only been spasmodic allusion to the subject at technical meetings during the year.

Regarding water-gas plant, there again there is little to chronicle. As previously mentioned, it played an important part in town-gas supply during the coal strike; and there is no question that it saved the situation for some gas undertakings in that critical period. But in reference to it as a process, we seem to have reached settled conditions of working. What, however, has been strongly impressed in the course of the year is that, for the attainment and maintenance of the highest efficiencies, there should be fairly continuous and complete supervision of all the details. The advice has been given that gas analyses should be made not only as a check on the quality of the gas, but as means of locating causes of inefficiency.

Tar-Surfacing of Roads.

Close upon these references to the secondary processes of gas-works, allusion may be made to two or three matters touching the utilization of tar for road surfacing and construction. The business in this connection has grown to such magnitude, and has had such an important bearing on the market value of tar, that the gas industry must keep a close watch upon any movement that affects it, or threatens to do so. There was at home increased application to road surfacing and construction during the year; and information came from other countries as to extensive use for the purpose. The Road Board made larger grants for the work; but there is a growing view that stronger road crusts with bituminous binding must be gradually adopted for modern traffic. At the same time, expert opinion accumulates that, apart from public convenience, there is a considerable saving in road maintenance by the application of tar to the surfaces. While referring to the Road Board, we are reminded that its specifications for tar for road use have been criticized by Messrs. A. R. Warnes and W. B. Southerton; and, at the time of the criticism, it was urged in these columns that a fairly liberal extension of the free carbon limit of the specification was called for. Subsequently, the Board relaxed the percentages that they originally prescribed [see "Journal," March 12, p. 720]. From information that we published regarding coke-oven tars, it was seen that the percentage of free carbon in these was well below the Road

Board's prescription. Occasionally, there was reiteration of the ill-effects of tar-surfacing upon fisheries and vegetation. Mr. W. J. A. Butterfield published the results of some interesting investigations that he had made as to the effect of tar on fish. The experiments did not reproduce ordinary conditions; but Mr. Butterfield claimed that they proved that tar, if reasonably free from ammonia and tar oils—"freed" tar—was absolutely safe to use in the vicinity of fisheries. Fisheries do not abound everywhere. An investigation was made by Herr Fischer as to the effect of tar surfacing on vegetation; and he failed to trace by comparison of experiences any substantiation of the allegation that there was a deteriorating effect. There were complaints made in Lancashire as to tar-surfacing affecting the foothold of horses; but where roads are sprinkled with granite chippings, this is not the case.

The Distribution System.

There has not been an extensive claim on our space during the year by the gas distribution system. From all over the world comes news of the adoption of high-pressure distribution; and information as to experiences in this work, and with boosting or pressure-raising plant, have continued to reach us for publication. Towards the end of the year, we heard of the favour in which turned-and-bored joints are held in South London and in Liverpool for gas-distribution work; and in the paper that Mr. W. George Head read before the Southern Association, some useful hints will be found. Publication was also made of quite a classical investigation carried out in America on the subject of the electrolysis of underground pipes. Insulation was advised as a minimizing factor; but counsel was also given that great care must be taken in the application in order not to waste money.

Touching gas distribution, the question was raised in the House of Commons as to the prevalence of thefts from prepayment meters; and interrogation of the Home Secretary elicited the fact that there had been an interview with representatives of the London Companies, who had offered to do all they could to mitigate the trouble by adopting stronger money-boxes and locks, by placing meters inside the rooms in the case of tenement houses, and by undertaking more frequent collection.

Testing on Gas-Works.

From intermittent, and not always methodical, testing on gas-works, the trend of things is to more continuous and systematic working. The belief is growing, and is supported by results, that, in complete scientific control of the operations of gas-works, there is economy and consequently profit. This applies not only to the larger, but also to the smaller, works; and the provision of continuously recording apparatus has placed at the command of the latter means such as they have never before had for attaining and protecting results. We have had from Mr. J. G. Taplay a description of his new apparatus for gas analysis by combustion over cupric oxide; from Mr. D. Chandler, of his apparatus for automatically recording the specific gravity of gas; and from Dr. L. A. Levy, of a means of rapidly estimating carbon dioxide. Pyrometers of the optical variety for use in gas-works have also been described. Dr. Rudolf Lessing has given us information as to his new system of ascertaining the coking properties of coal by the carbonization of a few grammes of the latter. Information was extended regarding the measurement of the flow of gas in mains by means of the Pitot tube in a paper explanatory of experimental work by Mr. A. R. Griggs. Intelligence came through a paper by M. Laurain, that M. Sainte-Claire Deville and his associates do not like the chemical process of determining the naphthalene content of gas, and have adopted one of a physical nature. A thin thread of gas in a glass tube is subject to sharp cold to a point at which the solids will deposit and obstruct the passage. Calorimetry has received considerable notice in one form and another, and will do so still more, in view of a commencement having been made in the application of calorific power as the standard of quality of gas in place of illuminating power. A useful book on the subject of calorimetry was brought out by Mr. J. H. Coste; and new patterns of calorimeters have been described. A Committee of the American Gas Institute have reported on the subject of calorific values, and are much in agreement with this country as to the conditions of a standard. But they are of opinion that a calorimeter which will give the total heating value of a gas is a thing to be desired. No sooner desired than available; for such a calorimeter has already been designed by Messrs. Simmance and Abady. The difference between gross and total values, however, is not sufficient to be regarded as material. Mr. Abady, by the way, disapproves of the calorimeter standing alone as a faithful guide of the full value of a gas to a consumer, without ascertaining the specific gravity of the gas, making careful analysis, determining the carbon density of the unsaturated hydrocarbons, and doing other things which are necessary for giving the consumer the best qualitative value for his money. Carbon dioxide and nitrogen are the things upon which Mr. Abady chiefly has his eye, in view of their effect on flame temperature. This reminds of M. Grebel's proposed test—"comburimetry"—for ascertaining the quantity of air required for the combustion of gas of different constitution. An explanation of this test has been published. Illumination photometers are a growing tribe, as descriptions of new comers have evidenced. Bearing on photometrical and illumination questions, it is interesting to note that there is now a project under consideration for an enlargement of the constitution and work of the International Photometrical Commission.

Technical Organizations and Educational Work.

The work of the technical organizations has been on an excellent plane, regarding the work as a whole, from that of the Institution of Gas Engineers, through the District Associations, to the junior organizations. The Institution has also been engaged in much external work (apart from the initial labour involved in the bringing into being of the British Commercial Gas Association) of a character beneficial to the entire industry. Its excursions into work beyond the pale of that purely technical in character are consistent with the position of the Institution as the central organization. The work it has done this year has led it into co-operation with the Commercial Gas Association, the Gas Companies' Protection Association, and the Society of British Gas Industries. This, again, is as things should be. The settlement of the allowance for depreciation in respect of income-tax, unemployment insurance, the strike clause in coal contracts, and education of gas-fitters, are among the questions in the determination of which the Council of the Institution have taken part. Mr. R. G. Shadbolt, as the President, up to the end of the annual meeting, took a prominent part in all this work; and the diligence and skill that he displayed received the heartiest of encomiums from his professional colleagues. At the annual meeting in June, he delivered a brilliant address; and his conduct of the proceedings did much to enhance their success. The subject-matter of most of the reports and papers presented on the occasion is noticed in other parts of this review. Between them they filled the days of the meetings with much value. The success of the whole was embellished by the character of the social events of the week, and not the least of the pleasant features in memory was the excursion made to Cambridge. Mr. Corbet Woodall succeeded Mr. Shadbolt in the presidential chair; and he is passing through the unique experience of being simultaneously President of the Institution, of the British Commercial Gas Association, and of the Society of British Gas Industries. His election as President of the Institution is associated with the jubilee of that body—next year being the fiftieth year of active service since the foundation of the originating British Association of Gas Managers. During this time of celebration, he occupies *de jure* the position of headship as the recognized leader in the profession, as the occupant of the highest place in its administration, and through his personal qualities. As the head of the Institution and as Governor of the Gaslight and Coke Company, he was the first witness for the industry before the Joint Committee of the two Houses of Parliament, in the successful fight with the chemical manufacturers in connection with the net of restriction which they were commencing to draw over the industry in respect of dealings in its residual products. He is giving warm personal support to those working for the success of the exhibition next year which will celebrate both the jubilee of the Institution and the opening year of the second century of statutorily-controlled gas supply. In association with the jubilee, an event will be the presentation of his portrait in oils to that veteran gas professional, and participator in many of the leading parliamentary and legal fights of the industry, Mr. Thomas Newbigging.

We must pass on. Looking farther afield, both the German Gas Association and the French Society had good

meetings. There was, however, nothing very eventful at either of them; although the Investigating Committees of both gave evidence of continued beneficial work, just as is the case with certain of the Committees of our own Institution. The Dutch and Belgian Gas Associations also had excellent annual meetings. Plenty of life has been exhibited by the Institute and various Gas Associations of America; but there is a fairly strong feeling that even yet the Institute is not all that it should be as the central organization for the American gas industry. Returning home, the District Associations held their usual meetings; and in most cases maintained their reputation for the quality of their proceedings. The Junior Associations again had a liberal output in the way of papers and discussions. Several of them were valuable contributions; while others (we do not wish to say anything here to discourage, but rather to encourage to aim higher) were somewhat scrappy and elementary. The best papers of the year are those giving the results of personal investigation into some particular subject. We can do with more of such contributions, and suggest that this is a line that the members of junior organizations should particularly cultivate, and, in presenting the results, keep their papers within readable limits.

Turning to educational matters, the University of Leeds—in connection with the Department of Coal Gas and Fuel Industries—apart from the special facilities provided for instruction on the higher plane for the gas industry's students, had the usual course of lectures early in the year; and a very attractive course has been prepared for the next three months, as noticed last week. Manchester and Birmingham Universities have also their special lectures for gas students; and valuable and instructive the lectures have been. The Polytechnics and other technical institutions are catering well for those who are, through geographical situation, unable to avail themselves of the University courses and lectures. The scheme for the education of gas-fitters, as previously mentioned, has been settled, and it is hoped will be taken up, and worked so as to produce advantage for the whole industry. In regard to the examinations in gas engineering and gas supply, an excellent list was published of the names of candidates who successfully faced the questions set by the respective examiners—Mr. Thomas Glover and Mr. Walter Hole. The reports of the examiners showed that there had been improvements in the results where there had been somewhat marked defects before. All candidates may be strongly advised to read the papers submitted by Mr. Glover and Mr. J. H. Brearley at the Institution meeting last June, together with the succeeding discussion. They will then get an indication as to where in the past the examiners have found weakness; and it should be the earnest endeavour of the candidates to help to keep these weaknesses as things of the past, and not to assist in perpetuating them by what they do in the present. In all industries there is a growing appreciation of the value of scientific training. The gas industry must not be behind in any way. It is for employers and their assistants to see that it is not. The provision for training exists.

There are three important incidents of the year to which we must refer, associated with the gas industry's interest in university life. First place must be given to the conferring by the Leeds University of the degree of Doctor of Science upon Mr. Corbet Woodall, Mr. Charles Carpenter, and Mr. Thomas Newbigging. The Manchester University likewise recognized the world-famed scientific work of Mr. Dugald Clerk by similarly honouring him. The second event was the resignation of the Livesey Chair by Dr. W. A. Bone, on the acceptance by him of the invitation of the Executive Committee of the Imperial College of Science and Technology of London to take up there the Professorship of Fuel and Refractory Material, with the supervision of the new Department of Chemical Technology. The third event was the appointment of Mr. John William Cobb, B.Sc., to succeed Dr. Bone as Livesey Professor.

Legislation.

The work of the parliamentary session really only had two or three salient features about it; and these have been kept so prominently before our readers that we may dismiss the proceedings on Gas Bills and Orders with the lightest sketch. The session will project in the history of the industry's affairs by the unwarranted attack made by the chemical manufacturers on the residuals powers of gas undertakings. Their success from the outset, on only a partial presentment of the case for the industry, led them to continue the request, and to fight where necessary, for the insertion of restriction in almost every Gas Bill and Provisional Order that came before Parliament. It was an incessant struggle, throughout which the gas industry pleaded for permission to put the case before Parliament from the point of view of the whole industry, including the principles and effects involved; but this was not permitted until mischief had been done time and again throughout the session. Then, and not till then, the persistence of the gas industry, represented by the Gas Companies' Protection Association and the Institution of Gas Engineers, succeeded; and Parliament appointed a Joint Committee of the two Houses to investigate the matter thoroughly, and report their findings for future guidance. This has been done; and the result is completely in favour of the industry within the limits in which they claimed the right to general free trading in their secondary products. From the very beginning of the fight, the "Journal" did its part in condemning the wrong that was being perpetrated, in pointing out the ultimate effects of restriction, and in helping to stimulate resistance to the limitation that the Joint Committee's report shows was being unreasonably imposed. The whole matter has been so prominent, and its latter and best phases so recent, that this brief reference in the retrospect will suffice, save that a very proper sequel to the business will be the promotion and passing of a Joint Bill to abrogate the restriction in the Bills and Orders of the session. To advance this proposition, a conference is to be held on the 9th instant, as notified last week.

Turning to more general matters, amalgamation in the gas industry and absorption of smaller undertakings continue to be features of modern legislation. Two large gas amalgamations were carried through Parliament this session—the South Suburban, Bromley, and West Kent Companies uniting their interests, and the Wandsworth, Mitcham, and Epsom Companies theirs. In these districts calorific power (excepting in a small part of the South Suburban area, and there only temporarily we hope) has superseded illuminating power as the standard of quality; and this opens a new chapter in the history of home gas supply. The expressions of the South Suburban clauses are the ones that should in future be followed [Oct. 15, p. 220]. Parliament shows a peculiar inconsistency in its rulings. In the Wandsworth Bill the absurd prescription of a 3 feet depth was imposed for pipes (unless otherwise agreed with the local authorities), while in the cases of York and Woking a 3 feet depth was very properly refused by the Committees. The prescription made in the Wandsworth Bill was at the instance of the Surrey County Council, and county councils and other road authorities (including railway companies) continued this session to press, but generally without much success, for more onerous conditions being imposed upon gas companies. In some cases, there was agreement on the part of promoters with conditions which grant more to the other side than the common law gives; and the wrong of such agreement was a matter of comment by the Chairman of one Select Committee during the session. Cases may be found, for instance, where promoters have agreed to allow road authorities exemption from liability for damage to pipes occasioned by the use of 15-ton road-rollers, and unnecessary depths for pipes have also been consented to in order to escape a contest. Gas companies should refuse to be bullied into this sort of thing. The second Standard Burner Bill went through without any opposition; the Benefit Funds Bills of the Brighton and Hove and other gas companies also received the complete endorsement of Parliament.

Allusion has already been made to one instance of parliamentary inconsistency. Another is to be found in the matter of the limitation of borrowing powers in the case of local authorities. In the Ashbourne purchase case, it was (following a precedent set last year) decided to place a limit to the borrowing powers, so that the District Council's affairs in regard to the gas undertaking should come up for review when the sum granted was exhausted; but in the Bedwellty and Sidmouth cases, there was not the same limitation. Why is not clear. The dispute of the Salford Corporation with the outside authorities as to the amount of gas profits that might be appropriated in relief of the rates was settled by the Corporation agreeing to a limit being placed on the appropriations. The lowest standard price on record—2s. 3d.—was imposed upon the York Company; but the Company are not likely to exist much longer, as, under a purchase agreement, the Corporation are now in

Parliament with a Bill to authorize the transfer to them of the Company's undertaking.

The Gas Companies' Protection Association (the Chairman of which is Mr. H. E. Jones) continued their good work throughout the session, not only by what was done in connection with the residuals fight, but also by what was accomplished in the matter of the National Electric Construction Company's Bill, which was to give parliamentary sanction to agreements effected with local authorities in connection with electric wiring, whereby the latter bodies (the whole proceeding was in excess of their powers) charged consumers an extra sum per unit with which to pay the Company. The result of the opposition by the Association was that, in relation to the towns with which they were concerned, the operation of the agreements entered into was confined to work already done. A singular position was created in connection with the wiring and fittings clause of the Sheffield Corporation. The House of Lords declined to allow them the right so to trade, except under the model clause conditions; but the House of Commons rejected the Lords' amendments, and restored the power as sought by the Corporation.

Litigation.

There have been no very imposing cases in the Courts in which gas undertakings were involved; but there have been several from which interest has issued. We must pass over all the smaller cases—such as prepayment meter thefts, and disputes of a minor description, as well as compensation cases without any feature of special importance. One singular case in this connection was that of a man who died as the result of metallic poisoning. He was a collector of coins from prepayment meters, and this was the alleged source of the trouble. But the action he brought against the Gaslight Company failed. A Clapham Common resident obtained £450 damages from the Gaslight Company for loss of an eye, through injury sustained by a piece of flying metal during main-laying operations. There was a claim made against the Manchester Corporation in connection with injury to a child's eye, through one of their inspectors leaving a knife open within reach of the child. It was proved that the Inspector was not in the house acting in the course of his authority; and the Corporation succeeded on this point, both at the Manchester Assizes and in the High Court. Another case was a claim against the Wandsworth and Putney Gas Company for damage in respect of illness caused by alleged negligence of the Company's servants in allowing gas to escape from a disused pipe. The plaintiffs were Mr. and Mrs. Roots. The Judge decided that there was no case to go to the jury in respect of the lady; and the jury could not agree with reference to Mr. Roots. They were consequently discharged. The Oldham Corporation brought an action for the recovery of costs incurred in repairing damage to a gas-pipe occasioned by a traction engine belonging to a contractor. It was decided that, as the contractor had a licence to use the traction engine, judgment must go against the Corporation. The Edinburgh and Leith Gas Commissioners lost in their valuation appeal. The Watford Gas Company were taken to Court by the Colne Valley Water Company in respect of river pollution; but there was a settlement, under which works were to be undertaken to obviate any possible pollution. In a case, however, brought by the Thames Conservancy, the Company were fined. The Colne Corporation were indicted for cutting off a gas supply to a house and business premises supplied through a prepayment gas-meter. The meter had been broken open, and the money stolen. The Corporation demanded repayment of the money from the tenant; he refused, and the supply was cut off. Judgment was entered for the Corporation. Mr. Schweder and the Worthing Gas Company, following up last year's engagements in Court, were again in contest over the question of the laying of gas-mains by the latter; and the Company succeeded. The Brighton Corporation (owners of the electricity supply) had an action brought against them in respect of some projecting signs and lamps. The Corporation, under a very ancient statute, which seems to have been a dead-letter until now, caused the removal of a shop gas-lamp, the only cause of its offence being that the name of the shopkeeper was inscribed upon it. The Corporation lost. A motion on behalf of Drakes Limited (the Tottenham and Edmonton Gas Company being defendants) to set aside the award of an Arbitrator failed. The Heathfield Natural Gas Company, the Kent County, and other concerns associated with notorious promoting gangs were before the Courts. The Sheffield Corporation, in connection with the trading of their electric wiring and fittings department, lost a case brought at the instance of local electrical contractors. Mr. Justice Eve ruled that the matter was governed by the Leicester case, and that the Corporation were, in carrying on the department, acting *ultra vires*. It will have been seen from the reference to parliamentary affairs that the House of Commons is determined that the Corporation, under the special circumstances of their case, shall have power to continue the department. In the libel action brought against the "Journal" by a man named Dostell, in connection with a "mantle-making at home" business, the plaintiff did not choose to face the Court, and judgment was entered for us. Awards were made during the year in the Mallow and Aberavon and Margam gas-works purchase arbitrations.

Labour Topics.

The country has learnt more during the year as to the depreciation of the security of industry through labour disputes; and there has been spasmodic consideration—but not so universally seriously as we should like to see—of the question as to the best way of obviating the recurrence of such troubles. The national coal strike and other strikes to which reference has been made earlier in the retrospect, with the labyrinthian difficulties and the mass of dire effect that these abominable means of trying to settle disputes presented, forced attention to this question of prevention; and some of the foremost politicians and industrial men of our times brought co-partnership into prominence as a means to that vitally necessary end. Co-partnership was discussed inside and outside Parliament; and what has been accomplished in the gas industry—it is the most notable of the examples of what can be done—was held up as admirable and exemplary. A Bill was introduced into Parliament for the purpose of facilitating the adoption by industry of co-partnership; and a report on profit-sharing and co-partnership schemes has been issued by the Labour Department of the Board of Trade, showing, *inter alia*, the importance of capital-holding to the permanence of the system. But withal there has not yet been anything material issue from the attention devoted to the subject, beyond making better known its merits; and that is, of course, something to the good. The Liverpool, the Aldershot, and the Hertford Gas Companies have extended the roll of co-partnership gas companies by adopting and applying the system during the year. The Gas Workers' Union ineffectually tried to breed discontent in certain centres where co-partnership rules; but the measure of their success was in inverse proportion to the uncomfortable knowledge derived by the Union leaders that their blatant abuse and misrepresentation were no match for the solid rock of co-partnership.

Variously charactered legislation was proposed as to trade disputes; and the Trades Union (No. 2) Bill was launched for the purpose of allowing funds to be applied to political purposes, on the conditions that the funds so applied are to be special, and from contribution to which members of unions who are unwilling to contribute should be exempt, and for these protection is also promised. The questions of national health and unemployment insurance have occupied considerable notice. The national health insurance was applied to the gas industry without much disturbance, though many of the workers of the industry are not so well off under it as they were previously under the companies' own schemes. In connection with unemployment insurance, the gas industry, through the decisions of the Umpire, know now who are and who are not men to come under the provisions of the Act in this respect. There has been trouble in Lancashire and elsewhere among municipal workers—trouble fomented by the unions—respecting rates of pay. Concessions were made in some places, and refused in others. Request was also made in various towns for the recognition of a minimum rate of wage. Salford experienced a brief strike, in which the gas men were involved. Stalybridge, as stated earlier in this history of the year, had experience of the stoppage of all municipal services. The British Gaslight Company have lately adopted the Continental system of awarding their men medals for long service; and this has been much appreciated.

Official Changes.

There have been a number of retirements from active service in the gas industry during the year and many official changes. Among those who have retired are many men who have registered long service in the industry. There is

Mr. Benjamin Green, who was for about 47 years with the Mitcham and Wimbledon Gas Company, and has since been a member of the Board. Mr. J. R. Frith, of Runcorn, only wanted one more year's service as Secretary and Manager of the Gas Company to complete half-a-century's service; Mr. Alex. Walker, of Irvine, after 40 years' service, relinquished his appointment. Mr. Charles M. Ohren retired from the Secretaryship of the South Suburban Company. Dr. W. von Oechelhaeuser resigned his position as General Manager of the German Continental Gas Company. Mr. W. J. Brender à Brandis gave up the reins of the chief engineership of the Antwerp station of the Imperial Continental Gas Association. Mr. Laurence Fletcher retired from the Managing Directorship of the Welsbach Company. Mr. C. F. Broadhead relinquished the gas engineership of Middleton to labour in pastures new at Brisbane. Mr. N. E. B. Garey retired from the Board of the Continental Union Gas Company, after a unique experience in the gas industry since 1847. For those who have retired from active service to take the rest to which they are entitled, we wish the health and happiness that are necessary to the full enjoyment of relaxation from duty. It is unnecessary to re-chronicle the official changes that have been made—their number is too great; and to mention some and not others is calculated to create an invidious feeling. Suffice it to remark that those who have gained the principal "plums" have been Mr. F. J. Bywater (East Greenwich works of the South Metropolitan Company), Mr. W. B. M'Lusky (Halifax), Mr. A. F. P. Hayman (Antwerp), and Mr. W. Wastell (Secretaryship of the South Suburban Gas Company). The last amalgamation of the Gaslight and Coke Company and other causes produced a reshuffling of the cards so far as certain of the station engineerships were concerned; and the same took place in connection with Birmingham on the transfer of Mr. Bywater to London. The junior members of the British gas profession have also been drawn upon for appointments abroad. All—mentioned and unmentioned—whose official *locale* has been changed have our heartiest wishes for their success.

The River Crossed.

In the midst of life, the interminable line of partings lengthens year by year. Some of those whose activities in the gas industry were severed a time ago, and have only just passed from among us, or whose activities were being continued close to the time of the passing hence are Mr. A. C. Fraser, Mr. John Smith Gibb, Mr. Andrew Gillespie, Mr. Richard Horton, Mr. Harold Iago, Mr. G. B. Irons, Mr. Thomas Layton, Mr. S. W. Ludbrook, Mr. John Moir, Mr. C. F. Ruggles, Surgeon-Colonel Taylor, Mr. G. F. Thompson, and Mr. Joseph Timmins. Others in the front line of commercial work in the gas industry who have finally vacated their places in the world's affairs, and whom we sincerely miss, are Mr. Freeman Burrows, Mr. J. L. Cloudsley, and Mr. Henry J. Davis. The stations occupied by all these in the gas industry, and the part they had in its work, have been described in our columns. There were others besides. From them all we have parted with profound sorrow. As the year closes that has produced its days of mourning for those near and dear to our friends who have "crossed the river," and as the season reawakens memories of them, sympathy prompted by long friendship passes to the side of those about whom lingers the shadow of their loss.

Accidents and Otherwise.

In the course of the year, we have had to record some sixteen fatal accidents at gas-works. Considering the extent of the industry's operations, some pride may be taken in the fact that fatalities are so comparatively few. Certain of them were due to negligence and to disobedience to orders. Others were pure accidents. The most notable mishap which occasioned the death of gas workers was the explosion in the meter-house at Stratford-on-Avon. There was no question that the meter overflow-pipe had been imperfectly constructed, in that there had not been sufficient margin to resist any abnormal pressure that might be thrown upon the water in the syphon. Among other accidents, there was the one to the Ilkeston holder, already referred to; and the railway siding accident at the Tunbridge Wells Gas-Works. There were fewer gas explosions during the year; and intelligence to hand only attributed to five of them loss of life. The facts relating to the explosion which wrecked the Albert Hotel, at Nottingham, were cleared up. It was due to the fusing of an electric cable and the generation of gas from the insulation. The Electricity Committee had to meet claims amounting to about £5000, and had to provide an annuity of £52 for the assistant manageress of the hotel. There was a case recorded of murder by gas; and some five persons committed suicide by its aid. There were some sixteen cases of suffocation by gas; but how many of these were due to accident and how many to design will never now be known. In some cases, however, there were found neglected defects in fittings and taps. There were two servants suffocated early in the year owing to want of intelligence in the fitting of a flue-pipe from a conservatory gas-stove. The flue-pipe was carried through the outer wall into the chimney of the girls' bedroom, and was allowed to discharge just by the register of the grate. There were two railway accidents during the year which raised the cry again for the abolition of gas-lighting on long-distance main line trains. This is a matter that is dealt with apart from the retrospect.

In Conclusion.

As this issue of the "Journal" is being circulated we are standing at the very dawn of a new year. What of its promise? Surveying the affairs of the industry to the horizon, there is visible but a single cloud, and that the sequel of the coal strike and of legislation affecting mining. In all other respects, the indications are clear and fair. Much, of course, depends on atmospherical conditions as to the measure of success the year will bring to the industry; but the diverse uses of gas generally stand us in good stead. The residuals markets also maintain good strength. Therefore we look for good results from the coming year's business and service to the community. It will be a year, with the Institution Jubilee celebration and the National Gas Exhibition, of more than ordinary interest to the gas industry. We hope, too, with the deepest sincerity, that it will be personally for all our readers and friends

A Year of Great Happiness and Prosperity.

Residuals Joint Bill Conference.

We particularly ask the representatives of those gas undertakings whose Acts and Provisional Orders of this session contain the residuals restriction not to neglect to have delegates at the conference on the subject of the promotion of a Joint Bill to annul the objectionable limitation. The conference, let us here repeat, is to be held on Thursday of next week (Jan. 9) at the Westminster Palace Hotel, at 2.30. To it, all companies and local authorities, in whose Acts and Orders the restriction appears, are invited; and it is important that all the undertakings—large and small—should be represented. It is possible that there may be some of the smaller gas undertakings embraced in this matter who may think that they are not immediately interested in the promotion of a Joint Bill for the purpose in view, on the ground that they are never likely to be buyers of the liquid bye-products of gas manufacture or of spent oxide, but always sellers; and as long as they have open markets for the sale of their own material, that is all they need trouble or care about. We ask the administrators of such undertakings to look at the matter in a broader spirit than that. There has never been a time that has shown more than the present how largely the interests of gas undertakings are intermingled, and therefore how great is the necessity for co-operation. It is just as important for the small undertakings to support the large in all matter of common interest as for the large undertakings to help to protect the interests of the small ones. We have seen in the past how powerful bodies have sought in the first instance to create precedent through the smaller and less influential concerns, whose power of resistance is not so great as that of the larger undertakings. Therefore there are very cogent reasons why the smaller undertakings should give to the larger undertakings their support in all matters of common concern and of mutual protection. This applies to this question of residuals restriction; and it may be taken by the smaller concerns that naturally the greater part of any expense incurred in the promotion of a Joint Bill will eventually be borne by the concerns of the largest business magnitude.

Make a Finished Job of It.

The gas industry has fought splendidly and won a complete victory in this matter; and it is the duty of every undertaking

with the residuals limitation upon it to do its part in making a finished job of it. It would be a pity to allow any remnant of the restriction to remain uncancelled on the Statute Book for a day longer than is necessary. No undertaking—large or small—which has been limited in its residuals dealings can tell what will be its position in this regard in the future. A small undertaking with the limitation upon it may be so located as to be the best centre for a combination for dealing with the residuals of a group of concerns. The restriction would spoil such an advantage. No undertaking—large or small—knows when it will find it necessary to supplement from neighbouring concerns its own supply of coke or tar in order to meet contract or local demands. The view of the Chairman of the Joint Committee and also of one eminent Counsel engaged in the recent contest (we gathered from the proceedings) was that, under the restriction as it stands, purchases even of this kind could not be made. Such limitation to trading is unthinkable when it can be removed at quite modest expense by joining in the projected Bill. To clear away the restriction is an essential to the victory that has been won by perseverance and devotion to the interests of the industry. Whatever, therefore, may be the nature of the views that have been entertained, we press all undertakings, both company and local authority, bound in their residuals dealings by the restriction to have representatives at the forthcoming conference. Presence there will commit them neither to expense nor participation in the promotion. The local authorities may have doubts on the subject, of joining in the promotion. If they join in it, and events make it advisable, any one of them can drop out at any moment. At the conference, all points at issue, all details, can be fully and freely discussed. What is said and what is done will be, under the circumstances, with closed doors; and it will only be by having representatives at the meeting that administrators of the undertakings concerned will have any means of fully ascertaining what is done. The whole matter will be discussed; and any one entitled to be present will have an opportunity of bringing forward any pertinent point for consideration. That is one purpose of the conference; the other is to attempt to evolve the details of a scheme of promotion that will commend itself to all concerned. From this, it will be seen that, at any rate, there is no excuse for abstension from presence at the conference.

Gas Tabooed by the Board of Trade.

Information has just come to hand of what cannot but be regarded as an extraordinary action on the part of the Board of Trade in connection with the lighting of buildings. It appears that increased accommodation was needed for a labour exchange in a town in the North; and a large building was secured. Thereupon the manager of the local gas-works immediately tendered the chief officer in the district the services of his expert, with the object of giving any assistance that might be required in rearranging the lighting of the building for the purpose intended. To his utter surprise, however, he received a letter from the Office of Works, in Westminster, expressing the regret of the writer that it was impossible to use gas in the exchange, as the Board of Trade had decided that "electric light should be installed wherever available throughout the country." This decision cannot be regarded as of a Free Trade nature. If the relative merits of the two illuminants are compared by the Board, they will find that gas, in its latest developments, has much in its favour, from the points of view of safety, of convenience, and of economy. At all events, it has shown itself to be a sufficiently good public servant to justify a claim to exemption from official ostracism.

The Baronet Hawker.

The gentleman who is able to style himself Sir C. B. H. Soame, Bart. (Solicitor retired) is still offering 200 6 per cent. preference and 200 ordinary shares in the New Toddington District Gaslight and Coke Company. The number of the shares on offer does not grow less. It was 200 of each class months and months ago. It is still 200. But the Bart. is getting wise, and still more artful. The shares were at one time offered at a minimum price of £4 10s. each; and then at £4. The public are suspicious of £5 preference and ordinary shares, on which a dividend of 6 and 7 per cent. respectively is guaranteed for three years, which are offered at £4 or £4 10s. each. The Bart. is now offering the shares at a "minimum" price of £5; and the dividend on the ordinary shares has been raised to 10 per cent. He is willing to "entertain" (such exuberant kindness on his part is not merited by the public) applications for three or more shares, within seven days of the receipt of the prospectus. It is a long time since that he said the same thing. However, the Bart. gives the modicum of information in the prospectus. He does not say who are the guarantors of the dividend; but he does not omit to mention that cheques should be made payable to Sir C. B. H. Soame, Bart., and be made out to "Bearer." Interesting as the Bart. is, his methods are still more so. *If* he has secured customers for 200 preference and 200 ordinary shares each time he has issued a similar prospectus to the one here under notice, the New Toddington capital must be growing to an extraordinary size.

Research Work.

The Council of the Institution of Electrical Engineers have decided to take up the question of research, and have appointed a Committee for the purpose. They are anxious not to overlap the work already being done by other Societies; and so it has been decided to confine the labours of the Institution in this direction to practically two lines, with numerous side branches running from them. The first one is the organization and correlation of research work in electrical engineering; and the other, the origination and supervision of specific researches in subjects connected with the electrical industry, and the allocation of grants in aid of the same. To the General Committee, investigators are to be invited to send particulars as to the subject and character of the researches they are undertaking. Members of the Institution, especially those connected with the manufacturing side of the industry, also are to be invited to communicate to the Committee any special difficulties they encounter which call for investigation, and to make suggestions for subjects for research. The General Committee will thus act as a species of "clearing house" for research topics—receiving suggestions from various sources and sending them on, after consideration, to the most suitable quarters.

Coal from America.

South Wales had a nasty shock the other day, which reminded of the purchases of coal during the strike by the South Metropolitan Gas Company from Nova Scotia, America, and Germany. Intelligence reached the Principality that the Egyptian State Railways had placed orders for about 100,000 tons of coal in American markets, and only about 60,000 tons in Wales. The Egyptian State Railways know the quality of the American coal as they had some 60,000 tons of it last year, in view of the strike. There are no definite figures published as to the cost, but 12s. per ton is mentioned and 32s. freight to Alexandria, which compares with 16s. for Monmouthshire coal and freightage of about 11s. 6d. The American figures cannot be taken as actual, as the difference in the cost of the coal delivered appears so large that a heavy amount of reason would be required to supply justification for the payment of any such difference on 100,000 tons.

The "Elland" and the Woodall-Duckham Vertical Retort Systems.

It is pretty well known throughout the gas profession that some questions have had to be raised before the Patent Office authorities in connection with applications for patents regarding vertical retorts by Messrs. Robert Dempster and Sons, of Elland, and Messrs. Woodall and Duckham, of Westminster. We now learn that the matter has been decided by the Comptroller-General of Patents. On July 22, 1911, Messrs. Dempster and Sons applied for five patents, and on Dec. 21, 1911, and Jan. 17, 1912, Messrs. Woodall and Duckham applied for two patents. The grant of patents to Messrs. Woodall and Duckham was opposed by Messrs. Dempster and Sons; and Messrs. Woodall and Duckham entered cross-oppositions to the grant of patents on three of Messrs. Dempster's applications. At the hearing, on the 11th inst. (at which Mr. J. M. Astbury, K.C., and Mr. Robert Frost, instructed by Messrs. Tasker and Crossley, appeared for Messrs. Dempster and Sons, and Mr. H. A. Colefax, K.C., instructed by Messrs. Abel and Imray, for Messrs. Woodall and Duckham), the Comptroller reserved his decision; but he has since given it in Messrs. Dempster's favour, with costs in all five cases—one of Messrs. Woodall and Duckham's patents being refused altogether, one granted with a specific reference to Messrs. Dempster's patent and the three cross-oppositions being dismissed.

ELECTRICITY SUPPLY MEMORANDA.

A Comforting Thought, but no Imitation—How to Secure Ultimate Victory—Optimism of Evelyn Boys—Poster Advertising Scheme—Old Master Gas-Fitters—Flame Arcs v. Metallic Filaments.

WITH "The Compliments of the Season," the Chairman of the Electricity Publicity Committee (Mr. A. F. Harrison) has sent out the December number of the Committee's "Journal," a specimen calendar for 1913 (the two ends of which for the four months of May, June, November, and December have to be reprinted owing to a printer's error), and a sample of a very demure looking circular on automatic water-supply pumps. About these, there is nothing particularly striking. The "Journal" is mainly devoted to an effort to stimulate interest and financial support in the work of the Committee. There appears to be a distinct lack of enthusiasm over entrusting funds to the Committee for expenditure, which suggests (and in the Electrical Press this has been said in very bold terms) that confidence in the Committee is not of a very high order. The Committee, in the editorial notes of their periodical, blow, with considerable vigour, the horn of self-satisfaction (they are bound to take this course, for praise from other quarters is very stinted). They tell their readers that the establishment of the British Commercial Gas Association was in the nature of "the sincerest form of flattery" to the Electric Supply Publicity Committee, though they do concede that the establishment of the Association was on bolder, more ambitious, and more effective and successful lines than their own effort. If it is any comfort to the members of the Committee, we will let them nurse the thought as to "the sincerest form of flattery;" but they cannot support the thought by the precedent word "imitation" which is requisite to complete the old adage. The British Commercial Gas Association can claim they have never from the start imitated former tactics of the Electricity Publicity Committee, in literature or posters, of abusing the competitor, and promulgating misrepresentation and falsehood, which, we know, was not to the minds of many electrical men an acceptable method of pursuing a fair commercial campaign. We grant that there has been a change of tone in the literature of the Committee; but we believe there is still much of the old literature still on sale and in circulation. The policy of the Gas Association is directed to educational, advertising, and (when necessitated by misrepresentation) defensive work. But the Association cannot be accused of having yet done anything of an aggressive nature, other than can be discovered in the facts of their existence and their activity in their legitimate functions. The presence of the Association in the field has had a wonderfully good effect in mitigating the more obtrusive and indefensible—and so because false—traits of certain of the old electricity propaganda work.

However, the Committee are not at all sure to-day which industry is going to ultimately obtain the premier position. They say: "Whether the rivalry proceeds upon friendly lines or otherwise, it is obvious that competition between electricity and gas must increase and grow keener, and ultimate victory will remain with the party best equipped to catch the public ear; and therefore electric supply authorities must place their own organization on a footing which will compare with that of its competitor." There is a doubt expressed here as to the side on which the "ultimate victory" will fall. But there is no such doubt expressed in an article in the Committee's "Journal" by Mr. Evelyn Boys, who is the Secretary of the North Metropolitan Electric Power Supply Company. This gentleman asserts that the "electrical undertaker has got the very best thing of its kind." That goes without saying. But then he proceeds: "It is *certain* that the electrical age is *assured in the near future*, when all traction, haulage, manufacture, heating, cooking, lighting, ventilation, and what not will emanate from the same source, electricity." With assurance of this condition of things obtaining in the near future, when all other sources of light, heat, and power will have been commercially eclipsed, there is no further need for the Electricity Supply Publicity Committee. They can receive their thanks and discharge, and bestow all their energy on other matters; for what is the use of working for what will inevitably come without any fuss, or bother, or expenditure. To work for such a positively assured end would be sheer lunacy! But the Committee are not in agreement with the optimism of Mr. Evelyn Boys. There is one factor, and only one, to ultimate victory, and that is the catching of the public ear. Nothing else matters. The public eye does not matter, nor the public intelligence. Merit of commodities for purpose does not matter. Quality and economy of light, reliability, heating values, and so forth—nothing of the kind matters. Ultimate victory will remain with the party best equipped to catch the public ear. As the Committee admit, with a condescension which includes their own inferiority as an effective organization, that the gas industry is better equipped than the electricity industry, it follows that commercial victory is at present on the side of the gas industry; and the gas industry has the assurance of the Electricity Publicity Committee (which includes Mr. A. F. Harrison as Chairman, Mr. A. C. Cramb as Vice-Chairman, and Mr. F. J. Walker as Hon. Secretary) that all it has to do is to maintain its superior equipment for propaganda work, and victory will remain on its side. But what of the certain feeling of Mr. Evelyn Boys that the electrical age is assured in the near future? There is something a bit disjointed about the arguments in the December number of the Electricity Publicity Committee's "Journal."

We rather fancy there are indications in a fresh movement on the part of the County of London Electric Supply Company of a languishing interest in the work of the Electricity Supply Publicity Committee, and of the literature of that body not being of a satisfying nature. This is all the more astonishing, if our surmise is correct, seeing that Mr. H. B. Renwick, the Managing-Director of the County of London Company, was formerly Chairman of the Publicity Committee. Perhaps Mr. Renwick has now tired of literature with foolish-visaged puppies sitting in front of an electric radiator, with an individual running like a lunatic with his coat-tails flying in the air, and showing by the back view a man of substance, and with men climbing about a gas-engine flywheel to start the engine instead of using the simple starting device for the purpose as fitted to modern gas-engines. Mr. Renwick may have been partly responsible for the introduction of some of this absurdity into commercial life; but if he was, he may be sobering down now to something that will appeal to householders as being far more sensible. His Company have started a "news sheet." It is headed "News-Sheet of the County of London Electric Supply Company;" and it is for the purpose of house-to-house distribution in the Company's area. The first issue gives information as to the Company; it contains some editorial notes; it illustrates the Company's offices and show-rooms; and it explains where they are to be found, and what is seen in them. It also describes various installations of electricity for various purposes in the district; and it describes new appliances. It is a legitimate and unobjectionable form of advertising. In the editorial notes, it is stated that "it is proposed in these news sheets, which will be issued periodically, to touch on various points of interest to consumers and others in the area served by the Company. The intention is to bring residents into closer touch with the Company, and to keep them posted 'up' in regard to the latest developments in the uses of the electric supply." There are three or four questions we should like to put to Mr. Renwick, in regard to the following paragraph:

> How do you light your nursery? The writer on "The Ideal Night Nursery" in "Every Woman's Encyclopædia" says: "Electric light is the best form of artificial light." Dr. George Carpenter (sometime Editor of "The British Journal of Children's Diseases") gives a similar recommendation: "The most healthy light that you can use is, of course, electric light."

The questions are: Who is the author of the statement in "Every Woman's Encyclopædia"? Does Mr. Renwick consider the metallic filament lamps the best for the eyesight of children, unless the filaments are completely obscured? Can he give us the address of Dr. George Carpenter? Lastly, can he tell us how long since it is that Dr. George Carpenter made the quoted statement? This is, we believe, the same Dr. Carpenter who said that sulphuretted hydrogen was one of the products of the combustion of town gas!

Still on the subject of publicity. It is announced in the Commercial and Industrial Section of the "Electrician" that the electricity supply industry is on the eve of a big campaign of appeal to the general public by means of posters on the street hoardings. Our contemporary is a little vague on the subject, and does not appear to be in possession of much information in regard to it. It is not in a position at the moment to state what "definite plans have been decided upon;" but it does know that "a poster scheme of advertising is in contemplation." Then there is solemn warning as to the pitfalls that there are in the selection of the class of posters for the purpose in view. It rather favours the style of heavy type, "backed by a suitable colour ground." "Backed by" might have been shortened by the use of the preposition "with." This by the way. "Give Them Bovril" strikes the counsellor of the electricity industry as a form of poster advertisement that arrests the eye. "Give Them Electricity" would not do without there was some mention of the safe voltage at which this could be done.

We have not seen the December number of the "Electrical Contractor;" but the "Electrical Times" informs us that there is an article in it dealing with the question of the poitions of the electrical contracting industry, and advising greater co-operation for the promotion of its commercial prospects. The electrical contractors are urged to action by having dangled before them what is called the parallel case of the gas industry; and they are asked whether they desire to suffer a fate similar to that which has overtaken the master gas-fitter. Not so many years ago, we read, this tradesman was a familiar and prosperous figure; while to-day he has practically ceased to exist. Then our information proceeds: "When electric light became a formidable competitor, gas undertakings realized that drastic steps must immediately be taken to encourage the use of gas for cooking, heating, and motive power; and they rushed into the gas-fitting business, hiring-out gas fires and cookers, and fixing them at rates which no private trader could afford to charge." Now in the first place, there is no genuine parallel between the gas-fitter and the electrical contractor. When the gas industry took up the business of gas-fitting and the supply of gas appliances, everything was altogether new. There was no parallel between what had been and what was to be. The gas industry was not then doing half the gas business that it is doing to-day. Gas fitting was mostly of a commonplace order; merely the running of gas piping and the supply of the plainest of fittings for flat-flame lighting. It was not, generally speaking, an extensive business then for any outside fitters, and there were comparatively few of them; for when once a house had been fitted up, there was nothing more to be done there for years. Everything changed. Incandescent gas lighting came in just about the

same time as cooking, heating, and prepayment meters, and the more extensive application of gas for power purposes. The gas business was thereupon transformed from beginning to end; and it constituted a business that the master gas-fitter could not, and would not, take up. It would have been the gas industry that would have gone to the wall if the changed conditions had been left to the "enterprise" of the master gas-fitters. They simply would not touch a business that involved heavy capital expenditure and, as they thought, speculation.

The fact of the matter is the master gas-fitter of the day was not competent in any way to deal with the business under the new circumstances. The gas industry did not take from him anything he had had; and it is only of late years that the gas-fitter of modern experience has in any way claimed that the gas industry has usurped his place in gas affairs. But the place is one that he never occupied, nor ever tried to occupy. We fail, therefore, to recognize any parallel between the ancient gas-fitter and the modern electrical contractor. The electrical contractor of to-day is a totally different man from the old master gas-fitter of flat-flame days. His knowledge is up to the times; his competence is equal to that of the fitter of the electricity undertaking; his business status is different altogether from that of the old master gas-fitter. Regarding the "formidable" competitor, incandescent gas lighting, gas cooking, heating, and motive power were not in anyway consequences of the competition. The incandescent gas-burner came to the gas industry opportunely, but true not as a result of competition. Cooking by gas had long been known before electricity came into the arena as a competitor; the developments in gas application have been the results of developments in efficiency in all the branches of the business of the industry. Considering the amount and character of the gas business that the master gas-fitter was doing thirty years ago, we cannot concede that he has been pushed to the wall by the gas companies. The business of gas-fitting has been so developed by the undertakings that employment for gas-fitters has increased to an extent that makes the business of thirty years ago look very diminutive when placed alongside for comparison.

In an article in the "Electrical Times," on street lighting in Cardiff, the case is stated for the adoption of metallic filament lamps in place of flame arc lamps for street lighting. It reads thus: To run flame arcs in parallel means considerable loss. To run them in series—which is the proper thing—means either special underground cables and switch and other controlling gear, or overhead wires. In Cardiff, there is already one of the principal streets lighted by means of flame arc lamps from overhead wires, the lamps burning five in series on a 200-volt circuit. But the accumulation of wires overhead is certainly to some extent unsightly, as there are not only these wires, and the necessary guard wires for them, but also the tramway trolley wires, together with guard wires; so that up above in this particular street there is quite a network. It was after very careful experiments with different types of lamps that they [who are "they"?] came to the conclusion that it would suit them better in Cardiff to adopt the arrangement which is now in use. The lamp consists of a cluster of five 110-watt lamps, each giving 100-candle power; and in the principal streets where there are centre poles for tramway purposes, there are two such lanterns on each pole, so that "in effect" one obtains 1000-candle power at each point. At midnight one lantern on each pole is turned down; while the other is left burning. Then we read that there are other advantages in connection with this particular form of street lighting—viz., that with five-light clusters the chances of all lamps giving out simultaneously are very remote, with the result that the standard is never without light of some sort. If one lamp fails, there are four lamps left burning; whereas with an arc lamp, if anything goes wrong with it, it most likely remains "out" all night. Reduced labour is also a point placed to the credit of the metallic filament lamp. The brotherly love that exists between the flame arc people and the metallic lamp advocates is becoming more notorious than ever.

THE GAS-TURBINE.*

HERE we have the story of the "theory, construction, and records of the results obtained from two actual machines," told by the inventor and designer. It may be said at once that it is not a book for the average reader of the "JOURNAL," as it is really only suitable for the expert on the internal combustion engine and the student in this particular subject. Probably not one in five hundred of the readers of the Technical Press devoted to the gas industry would appreciate the work under review. For the most part, it is a collection of abstruse theories on the working of the gas-turbine, largely explained by a liberal use of elaborate formulæ understood by few but the student and teacher of higher mathematics. Far be it from the reviewer to exhibit any want of appreciation of the author's clever work, which to the few will be of much interest and great benefit. It is assumed that the reader has some elementary knowledge of the subject. This, in itself, limits the scope of the book; for there are few who know anything at all except the rudiments of this type of internal combustion engine.

The author describes his gas-turbine, which is rated at 1000 horse power and which has so far been made to develop 450 B.H.P. with an efficiency of 23 per cent. This engine has been built to his design, and resembles the Curtis type of steam-turbine. One of the features of the Holzwarth turbine is that the air and gas are supplied under pressure from turbine compressors worked by steam generated by the waste heat of the exhaust gases. This is certainly a development in the right direction; and should the engine become a commercial success, it will probably be due to this economical utilization of the waste heat. The reason of this is that the power required for driving the compressors is, in some cases, as much as that needed for driving the turbine itself. From this fact, the significance of the author's method will be apparent. Such research work as is described in the work under review is likely to be invaluable in aiding to develop the gas-turbine; but there are so many pessimists among the highest authorities that a worker in this fascinating subject needs a great deal of courage. Such a man is to be found in Mr. Holzwarth.

As to the book itself, it is divided into four parts, entitled respectively, "Theory of the Gas-Turbine," comprising one-half the volume, "Construction of the Gas-Turbine," "General Comparison of the Reciprocating and Rotary Engine," and "Results of Tests." Contained within it may be found a fairly complete discussion of the entire problem, the whole of which is treated from a high scientific standpoint. As already mentioned, it is a suitable book for the man of some mathematical attainments, and for those who wish to study, not the mere fringe of the subject, but the technical details involved in the design, construction, and working of the gas-turbine.

The translation is well done; but why have not the measurements and weights been calculated to their English equivalents? This fault is a bad one, and is always a source of worry and annoyance to the reader—not to mention the reviewer.

* By Hans Holzwarth, Engineer. Translated by A. P. Chalkley, B.Sc., A.M.Inst.C.E., A.I.E.E. London: C. Griffin and Co., Limited. 7s. 6d. net.

PERSONAL.

Mr. ALEXANDER BEATON WALKER, the Engineer and Manager of the Walker and Wallsend Union Gas Company, has been appointed a Justice of the Peace for the borough of Wallsend-on-Tyne.

Mr. PETER BLAIR, of Messrs. Parkinson and W. & B. Cowan, was operated upon for appendicitis on Christmas Day, and is now at a private nursing home in Darlington. His many friends and acquaintances will be glad to learn that he is going on very well indeed.

Owing to ill-health, Mr. R. THOMAS GLOVER has resigned his position as Chairman and Director of Messrs. Glover and Main, Limited, and the two allied Companies—Thomas Glover and Co., Limited, and R. & A. Main, Limited. Mr. ROBERT B. MAIN has been elected Chairman.

At their meeting last Friday, the Board of the Newport (Mon.) Gas Company appointed Mr. THOMAS CANNING, Assoc.M.Inst.C.E., a Director, in succession to the late Mr. Charles David Phillips. Mr. Canning retains his position as Engineer to the Company; while Mr. J. H. CANNING has been appointed as Manager of the Crindau Gas-Works and Assistant-Engineer.

Out of a list of about 100 applicants from all parts of the kingdom, and two from America, Mr. MATTHEW D. CAMPBELL, the Manager of the Stewarton Gas Company, Ayrshire, was unanimously appointed Manager of the Fraserburgh Gas-Works at a special meeting of the Town Council. Mr. Campbell served for nine years in the Hamilton Gas-Works, and has been Manager at Stewarton for the past seven years.

Residuals Dealings Decision.—The electrical papers have been interesting themselves in the discussion the gas industry has had with the chemical manufacturers on the subject of the restriction of the markets for the sale of raw residuals. It is recognized by the competitors of gas that liberty in the matter of residuals dealings is of importance to the gas industry in relation to the price of gas. "Electrical Industries" refer to the subject in a very fair manner. Speaking of the decision of the Joint Committee, our contemporary says: "This is so broad a charter that it is difficult to see what the chemical manufacturers have obtained by their attack. The only important restriction suggested by the Committee is that 'gas undertakings shall not be allowed to manufacture chemicals exclusively from raw materials bought from sources other than gas undertakings, or in the manufacture of which the use of residuals produced by themselves or bought from other gas undertakings is merely subsidiary.' Within certain limits, therefore, the chemical manufacturers will still have to face the competition of bye-products. This arrangement is consistent with the Free Trade principles which leading chemical manufacturers uphold in politics; but it is a blow to the monopolistic principles they seek to establish in business. They would have done better if, instead of fighting, they had offered gas undertakings so excellent a price for their residuals that these undertakings would never have troubled about working-up products for the market."

LIGHTING OF RAILWAY TRAINS

And the Ditton Junction Disaster.

IMMEDIATELY after the Ditton Junction Railway disaster on Sept. 17, there were newspapers in the country that made scandalous allegations concerning gas having contributed to the horrors of the occasion. This was done in the interests of the electrical industry, some of the fervid workers in which find any tale or any gruesome details that rumour sets in circulation good enough for their purpose. The report of Lieut.-Colonel Yorke, R.E., C.B., on the results of his inquiry, on behalf of the Board of Trade, into the catastrophe has now been issued; and anyone who carefully reads the report and the evidence accompanying it, with, to assist him, some pertinent technical knowledge, will readily see that the case, on the facts as presented, is extremely weak against the use of gas, just as it was in the case of the Hawes Junction disaster. We do not accuse the Inspectors in any way of bias. They have chosen to regard gas as suspect in relation to contributing to fires on wrecked railway trains; and, this being so, they appear to assume that what they suspect is really what happens, though there is no direct or definite evidence to support the assumption. Whether it is wise, through official reports, to disturb public confidence on such unsubstantial grounds as we have in the present report, is for those in authority to say. We incline to the opinion, as we have a right to do, that it is not. Before gas was introduced into trains there were train fires resulting from accidents; and the same conditions that then obtained obtain now, with an accentuation of the fire liability through increased speed, and the greater resulting wreckage. We venture the view, after reading Lieut.-Colonel Yorke's statement as to the conditions surrounding this catastrophe—the wrecking of the engine, and the smashing of the dry-wood coaches, with the flame, sparks, and incandescent fuel flying about from the engine—that the conditions were all there for the conflagration that ensued, independent of any question as to how the carriages were illuminated. It is insufficient to condemn, on mere assumption or opinion, any system of illumination that is economical, is reliable, and is for the passengers' sight and convenience the preferable means of illumination, unless there is the clearest possible evidence that the system is dangerous—dangerous not under normal conditions, but conditions that are abnormal. It must be borne in mind (and we say this with every respect for the Board of Trade Inspectors) that the technical advisers of the railway companies are as equally qualified as they are in judging as to the degree of danger that exists, under any circumstance, in connection with gas illumination. During the recent few years, there have been many electrocutions through the use of electricity on railways, in places of industry, and in private establishments. There have also been several deaths from burning through fires caused electrically. But there have been no recommendations in consequence that railways or industry shall return to steam, or that places that are electrically illuminated in which deaths have occurred through conflagration electrically generated shall return to a system of illumination that in those places never had such dire result.

A GOOD RECORD.

There are two general points to which we wish to allude before examining the details of Lieut.-Colonel Yorke's report within the limits of our immediate interest. In fairness to the London and North-Western Railway Company, Lieut.-Colonel Yorke says that gas has been used by the Company on their trains for thirty years, during which period 2937 million passengers have been carried; and this is the first occasion on which it has been suggested that gas has been concerned in the burning of one of the Company's trains. Is not that a clean record? The good reputation of gas in having been non-contributory to railway train fires was also attested in the report by Major Pringle on the Hawes Junction disaster. In the report he said: This is actually the first occasion when it can be proved beyond question of doubt that fire was occasioned by burning gas. It has to be remembered also that it has been in use for lighting purposes for a very long period, and that during the whole of that time—in fact, since the year 1868—there is no case of fire destroying either the lives or bodies of passengers in railway accidents." On the evidence advanced in both these cases, we really cannot understand the attitude of the Inspectors in this matter.

BURNING OF HUMAN BEINGS.

These reports by the Board of Trade Inspectors are utilized to its discredit) by the electrical industry in the commercial campaign against the gas industry; and the daily papers give circulation among the public to the findings of the Inspectors as though the latter were infallible, and their views with regard to this lighting question were based on substantial evidence as to gas being a contributory cause of the firing of wrecked trains. Those responsible for giving publication in the Daily Press to the views of the Inspectors on this point are not qualified to analyze the evidence on their own account; and therefore they accept as *ex cathedrâ* the utterances of the Inspectors—utterances made, we have not the slightest doubt, in all good faith. But these utterances are magnified; the electrical press—one paper in particular—has been guilty of magnifying them. Electrical journalists have gone the length of talking at large regarding the horrors of persons being slowly burnt to death, and all through the use of gas on trains—a statement which in no single case the Inspectors of the Board of Trade have verified, and, in fact, freely acknowledge that they cannot do so. In this regard in connection with the Ditton Junction disaster, Lieut.-Colonel Yorke says:

> The dead bodies of thirteen passengers were recovered from the wrecked and burnt carriages. The first accounts stated that all or nearly all of these were badly burnt. It is a melancholy satisfaction to be able to say that as far as I could ascertain, those statements were exaggerated, and that the horrible fear that arose, that some of the victims had been burnt to death, was devoid of foundation. When the bodies were first removed from the wreck, many of them were blackened by dirt, water, ashes, and burnt wood; and their appearance gave rise to the impression that they had been burnt. But both Sergeant Instructor Dwyer and Staff Sergeant Watson state that, as far as they could see, the dead had all been killed in the wreck of the train, and none of them had been burnt to death. I have also received a statement from the London and North-Western Railway Company, showing that the injuries other than burns of each of the thirteen passengers who were killed were sufficient to account for death. In only two cases were the bodies badly burnt, and in one case scorched. . . . The Coroners' juries who investigated the cause of death made no reference to fire in their verdicts.

What have the newspapers that published the ghastly and untrue details to say to this refutation of their misrepresentation. Seeing that some time elapsed before the dead bodies could be removed from the *débris*, this alone gives strong denial to the point that gas contributed to the fire; and it serves, it seems to us, as a contradiction to some of the assumptions on the matter in the report. If the gas caught fire before it was dispersed, on the connections being broken, the fire would have started immediately the accident occurred, and would quickly have obtained such hold that, terrible as it would have been, there would have been greater evidence of the burning of the bodies. But we maintain that the carrying of the gas under pressure is one of the greatest safeguards in such a catastrophe as this, inasmuch as the high pressure would contribute to its rapid dispersion immediately the connections were severed. But more as to this presently. It is a satisfaction to have Lieut.-Colonel Yorke's report as to death having been caused by the accident itself, and not by burning.

THE HOLLOWNESS OF THE CASE AGAINST GAS.

We can hardly imagine the circumstances of a railway accident presenting less effective evidence on which to build a case for the abolition of gas for railway carriage lighting than this particular one. There were nine coaches in all: Two of them were horse-boxes lighted by oil, five were passenger carriages lighted by gas, and two carriages were electrically lighted. The Inspector speaks of the high speed at which the train was running when the engine left the rails, and came into violent contact with one of the piers of the bridge where the accident occurred. So terribly severe was the impact that the engine broke its back. The barrel was torn away from the fire-box; and the rivets round the top of the boiler, half way down each side, were sheared through. This shows that the impact between the engine and the pier of the bridge was exceedingly violent; and what the awful effect of this upon the succeeding derailed coaches must have been can be pictured without the aid of the report. We read in the report that the first five coaches, including the two horse-boxes, ran past the engine; and that some of the coaches or parts of them must have forced their way over the engine. The two carriages in which the fire raged most furiously were those that were completely smashed up, and which were lying nearest the engine when it came to rest. The smashing-up of the carriages promoted conditions that assisted in their readily catching fire and burning. Unfortunately, in view of the assumption that ensues, these carriages were lighted by gas. Even one of the electrically lighted carriages that was not wrecked in the same way easily caught fire.

This brings us to the assumption that gas had some part in adding to the intensity of the fire. What are the facts? Each coach carried two gas-cylinders each of a capacity of (at 100 lbs. pressure per square inch) 56 cubic feet of gas. It is probable, says the Inspector, that these cylinders were not more than half full. This being so, each cylinder would only have (say) 28 cubic feet of gas to disperse; and that 28 cubic feet at high pressure! Of course, the pressure would be reduced as the gas escaped. Lieut.-Colonel Yorke found that the cylinders themselves were only dented—not fractured; but the pipes and connections were broken off—thus liberating the gas freely to the open air. Being under pressure, the bulk would very quickly be dissipated. One of the witnesses says that when the engine struck the bridge, he saw a volume of flame burst from the former; and this, the Inspector says, *probably* set fire to any gas that *might* be escaping from the carriages as they passed the engine. This is pure conjecture; and we ask in all seriousness whether it is sufficient for the condemnation of gas. "Apart from this, it is well known," remarks the Inspector, "that a very small spark is sufficient to ignite gas when escaping into the air; and *there must have been plenty of red-hot cinders from the engine and sparks from the wheels flying about the train during the process of destruction.*" Seeing the condition of the smashed-up carriages—supplying ample and readily ignitable combustible material—with hot cinders scattered about in all directions, is it not fairer to assume that here there were all the elements necessary for the fire without bringing 28 cubic feet, or thereabouts, of gas in each cylinder into the question, and that gas under pressure in cylinders "the pipes and connections from which were broken off, and the gas free to escape"? We go on, and read: "The immediate appearance of fire, the rapidity with which it spread, the fierceness with which it burnt, and the manner in which it resisted for nearly *two hours* all the efforts to quench

it, *can, in my opinion, only be attributed to the presence of gas.*" Where could the gas have come from to have supported the combustion of the wreckage during such a length of time, under the circumstances of its discharge from the cylinders? Does Lieut.-Colonel Yorke wish us to assume that gas under the pressure (true a reducing one) existing in the cylinders and "free to escape" as he suggests, and of the quantity that he believes to have existed in the cylinders at the time of the accident, was sufficient to contribute to the maintenance of the fire for nearly two hours? The fire first showed itself in the heap of wreckage nearest the engine, as we see from the plan accompanying the report. The proximity of wreckage to the engine was surely sufficient to cause the fire without any aid from gas.

We have very diligently examined the evidence to ascertain from it when fire was first noticed. Lieut.-Colonel Yorke speaks of the "immediate appearance of fire," and of the "rapidity with which it spread." The fact already referred to regarding the condition of the bodies assists to repudiate the suggestion as to the "immediate" appearance of the fire. The accident occurred at 6.5 p.m.; and the observations of the witnesses as to when the fire started vary considerably, which is natural under such exciting circumstances. The times mentioned are anything between ten minutes and upwards of half-an-hour after the accident, when the witnesses individually first observed fire. It is more likely than not that the shorter period is true; but this points to an appreciable time elapsing between the high-pressure gas obtaining freedom to escape, and when the fire broke out. We really cannot, looking at the evidence as judicially as we can, find any support for Lieut.-Colonel Yorke's condemnation (for that is what it resolves itself into) of the use of gas for the lighting of railway trains.

In the portion of the report upon which we have been commenting, the Inspector remarks:

> The arguments for and against the use of gas for lighting trains are fully given in Major Pringle's report, dated Jan. 31, 1911, upon the collision which occurred at Hawes Junction; and it is not necessary for me to repeat them here. Major Pringle came to the conclusion that, although steps might be taken to lessen the risks attendant upon the use of gas, "electric lighting would still be the safer method," and "should be adopted wherever possible." It is to be regretted that up to the present time no unanimous action has been taken by the Railway Companies to meet the representations of the Board of Trade, which were based upon the above report. Some companies are in favour of electricity, while others champion the use of gas. The chief point on which opinions differ seems to be that of cost. I have been personally assured by responsible railway officers that gas is far the cheaper illuminant of the two, while other officers equally responsible have been confident that the balance is in favour of electricity. In view of these conflicting opinions, it may be assumed that the difference in cost does not amount to much, and depends chiefly upon what items are included in the term "cost." So far as safety is concerned, there can hardly exist in anyone's mind a doubt that electricity is the better; and I think the Railway Companies would be wise to recognize this fact and adopt electricity as the standard illuminant on all their main-line trains before they are compelled to do so by the pressure of public opinion.

Again, we ask what is there in the evidence, or in the history of electric lighting, to justify Lieut.-Colonel Yorke in these final representations?

THE METAL TRADES IN 1912.

THAT the past twelve months has been a period of high prices for commodities generally, consumers will universally be prepared to admit; and this in itself is a condition which, if the circumstances are normal, is accepted as proof that trade is good. It would be correctly so accepted on the present occasion, as many things show, though perhaps some people will feel diffidence in going so far as Messrs. Bolling and Lowe, who, in their annual metal trades review, remark that 1912 will stand out as "the Banner Year" of British prosperity. But however this may be, it is gratifying to find that the firm see no reason why, with an absence of labour troubles and a settlement of the European complications, the present prosperous trade conditions should not continue throughout 1913.

The evidence of exceptional prosperity which is seen in all industrial countries is, the report states, accentuated in the iron, steel, and allied trades. Early in the year there was confidence in the future of the pig iron market; and this was maintained, in spite of the labour troubles which interfered with transit. The quantity in store at the middle of this December, at 281,983 tons, was actually not quite 50 per cent. of that of a year ago—namely, 598,028 tons; while the price of Cleveland pig iron advanced from 49s. 6d. per ton in January to about 68s. as Christmas approached. In the period from April to the end of June there was little variation in the price; but an increase of nearly 3s. per ton was recorded then, and since that time there has been a series of rises without a single appreciable setback—"the persistent strength of the market being almost unparalleled." It was estimated in the 1911 report that that year's production of pig iron for the United States would be about 22,000,000 tons, while the actual figure was nearer 24,000,000 tons. Messrs. Bolling and Lowe think, however, they will be fairly accurate if they estimate about 29,000,000 tons for 1912. In 1911, the German pig iron production was 15,652,000 tons; whereas the estimated figure for 1912 is 17,250,000 tons. In the matter of finished iron and steel, favourable trading is recorded. Early in January, we learn, a strong tone set in; the price of marked bars—the barometer of the iron trade—being raised 10s. per ton. Other advances occurred subsequently, until in August marked bars touched the highest price reached for about eleven years. There was lately a further advance in steel quotations; and the opinion is that the strength of the market is fully sustained.

Turning to other matters, Messrs. Bolling and Lowe point out that combines are on the increase. Early in the year, the Scottish Malleable Iron Combine was formed, to put an end to the competition of fifteen different companies; and similar organizations have more recently been formed in connection with the light castings and the brass makers. An announcement was made in the spring that a revival was likely to take place of the manufacture of wrought iron (which had been practically superseded by steel), as it can be more reliably used for certain purposes; and the opinion is expressed that an increase in its use is likely, though the heavy outlay in recent years on new steel plant will probably act as a check to any very appreciable development of wrought-iron production. The weakest spot in the trade of this country has, it seems, been the demand for steel rails—statistics showing that there has been no improvement in this direction, but that the increase in price has been in sympathy with general advances and the rise in the cost of raw material. The reviewers remark that, as the result of prolonged investigations regarding the quality of steel, the Bessemer process has been largely superseded by that of the open hearth, and it appears that the time may not be far distant when this class of rail will be supplanted by that of electric manufacture. The idea is that though the original cost of the lines would no doubt thereby be increased, the expenditure on renewals might be lessened. The increase in the exports of galvanized corrugated sheets has been proportionate to that of other goods; but with respect to tin plates, a slight decrease in quantity falls to be recorded.

The copper statistics are, of course, interesting, as for a great part of the period under review, at any rate, the market has been in an extremely strong position—the price of standard metal rising from about £61 per ton early in the year to something like £80 in the middle of June. This was a continuation of the position of affairs existing in the latter half of the previous year, when the price was taken from £53 to £64. On Dec. 31, 1911, the total visible supply was 110,619 tons—a figure which, by June 30 last, was reduced to 67,930 tons. After this, however, the visible supply increased steadily, in consequence of accumulations being in progress at the United States refineries, which more than counterbalanced a drain on the reserves in Europe. As a result, the market suffered a diminution of buoyancy; and to Messrs. Bolling and Lowe, just at the present, and on the basis of current supplies and demands, copper, judged from a broad standpoint, seems sufficiently dear. To show the extent to which the production of the metal has increased, it is remarked that the United States output for the first eleven months of 1911 was 584,000 tons, while for the same period of this year it has been 642,000 tons. Thus a monthly average of 53,000 tons last year, has this year been converted into one of 58,500 tons. Tin has been a less erratic market than for years, arrangements designed to render manipulation more difficult having proved very efficacious. All things considered, it is urged that the advance to over £230 a ton was, on this occasion, more or less justified by the intrinsic merits of the position. Late in the year, however, circumstances combined to prejudice sentiment somewhat, though prices did not fall far below the best of the year.

In a closing paragraph, the reviewers point out that commercial prosperity gives an impetus to important undertakings in various parts. "Internal-combustion oil-engines on the Diesel system for ship propulsion and for locomotives are," they say, "having exhaustive trials, and considerable difficulties have to be encountered. But once these are overcome, a revolution in transit is the inevitable result. Substantial progress has been made by the Tata Iron-Works Company; there is a proposition to establish steel works in the Transvaal under favourable auspices; another for steel works in New South Wales—probably under State control—as well as in Nelson (N.Z.); and great activity is reported in Australasia."

There are as usual included in the review figures as to our exports of iron and steel, and their value, for the eleven months ending Nov. 30 of each of the past three years. The figures for pig iron are given as follows: Year 1910—1,119,478 tons, value £3,823,726; 1911—1,070,436 tons, value £3,435,829; 1912—1,180,900 tons, value £4,278,360. The total exports of iron and steel were: Year 1910—4,354,434 tons, value £39,829,712; 1911—4,241,911 tons, value £40,445,742; 1912—4,434,368 tons, value £44,279,332.

Electrically Sterilizing Water.—A plant for electrically sterilizing water by means of electrically-produced ozone has been erected at a station of the Baltimore County Water and Electric Company in Maryland. It has been found, says "Electrical Engineering," that the area necessary is only a tenth that required for rapid sand filtration. The ozone generator is 33 inches high by 33 inches diameter. A large number of aluminium tubes are used for the production of the electric discharge. Each unit can deal with a million gallons of water per 24 hours, and requires five kilowatts—*i.e.*, about 18 watts per square foot of electrode surface.

THE GLOVER-WEST INSTALLATION OF VERTICAL RETORTS

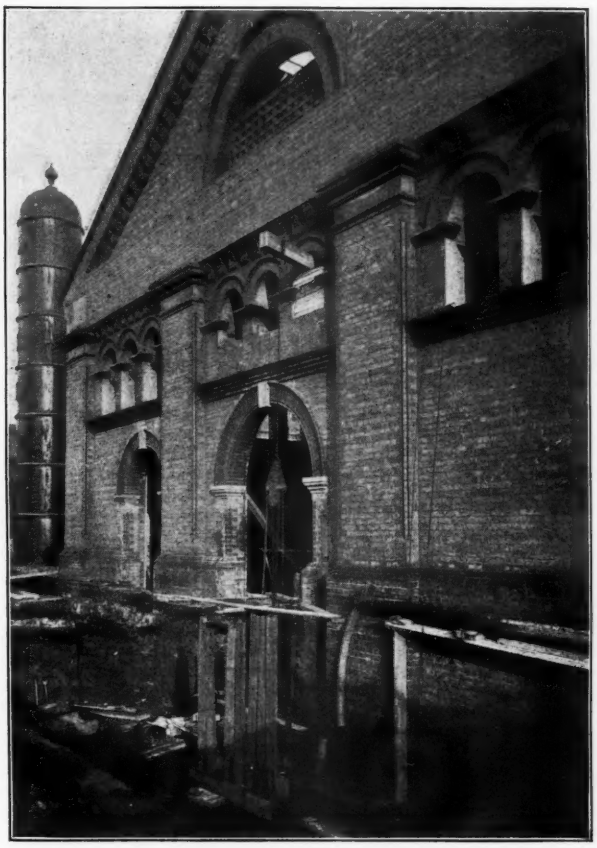
AT THE RADFORD GAS-WORKS, NOTTINGHAM.

In last week's issue, pp. 962-3, we were enabled to publish some particulars as to the present condition of gas affairs in Nottingham, which (as remarked) "are destined to effect some striking changes locally in relation to methods of gas production." To-day we resume the story by giving details of the Glover-West installation of vertical retorts now being proceeded with at the Radford works, under the direction of Mr. John Wilkinson, the Gas Engineer to the Corporation.

The first instalment of the contract entered into with West's Gas Improvement Company, Limited, of Manchester, consists in the provision of 48 retorts, arranged in six beds of eight. The retorts are made up in ten lengths of about 20 feet each; the average length of each section being 1 ft. 10 in.—the centres of the buckstays being 11 feet apart. The retorts are of oval shape, measuring 2 ft. 3 in. at the top and 5½ inches more at the base; the dimensions the other way being 10½ inches and 1 ft. 5½ in., the thinnest part being at the top. Each section is constructed with a special clay joint, and they are lipped all round to carry the different floors of each chamber.

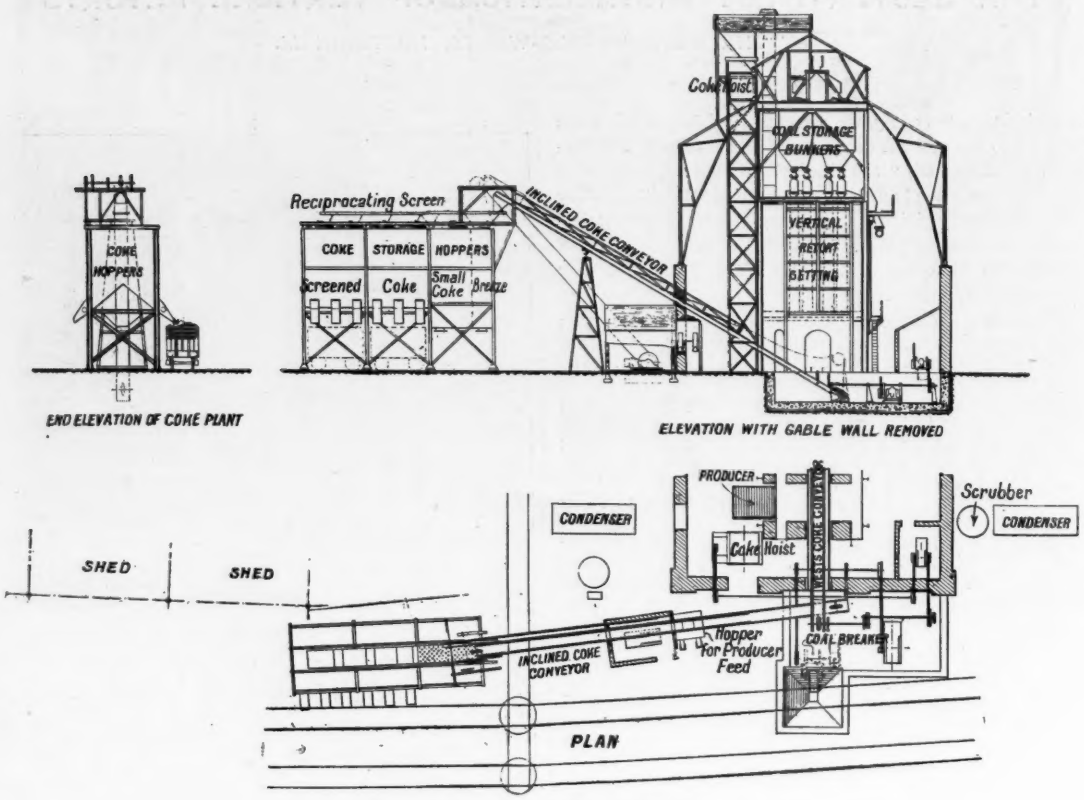
The chimney shown in one of the photographs is doomed to ultimate demolition, but it is quite a striking architectural feature amid the otherwise sombre surroundings; the structure being of excellent terra-cotta work, entailing originally an expenditure quite disproportionate on the score of ornamental detail to the real utility involved. It is 120 feet in height, and is surmounted by a cast-iron cap. Each setting of the new plant having its separate chimney, the necessity for the larger shaft will no longer remain. That the cost of demolition will, however, be more than compensated for by the value of the materials, is obvious from their present excellent condition.

Reverting to further details of the new work, it may be explained that the width of the bench is 23 ft. 6 in.; the producer, which is 7 feet wide, standing out 7 ft. 6 in.—making the total width of the benches 31 feet. The heats travelling around the separate lengths of the retorts are controlled by independent combustion chambers, each being provided with separate secondary inlet nozzles and producer gas inlets; these being controlled by dampers. The old-retort house, which is being utilized for the installation, has a 60 feet span; the distance being 98 feet from the centre of the chimney to the gable. The necessities of the work will involve an early removal of the present roof and the raising of the walls from 20 feet to double this height; so that ere long the Radford depôt will be transformed beyond recognition. Although in the immediate vicinity there are to be found some of

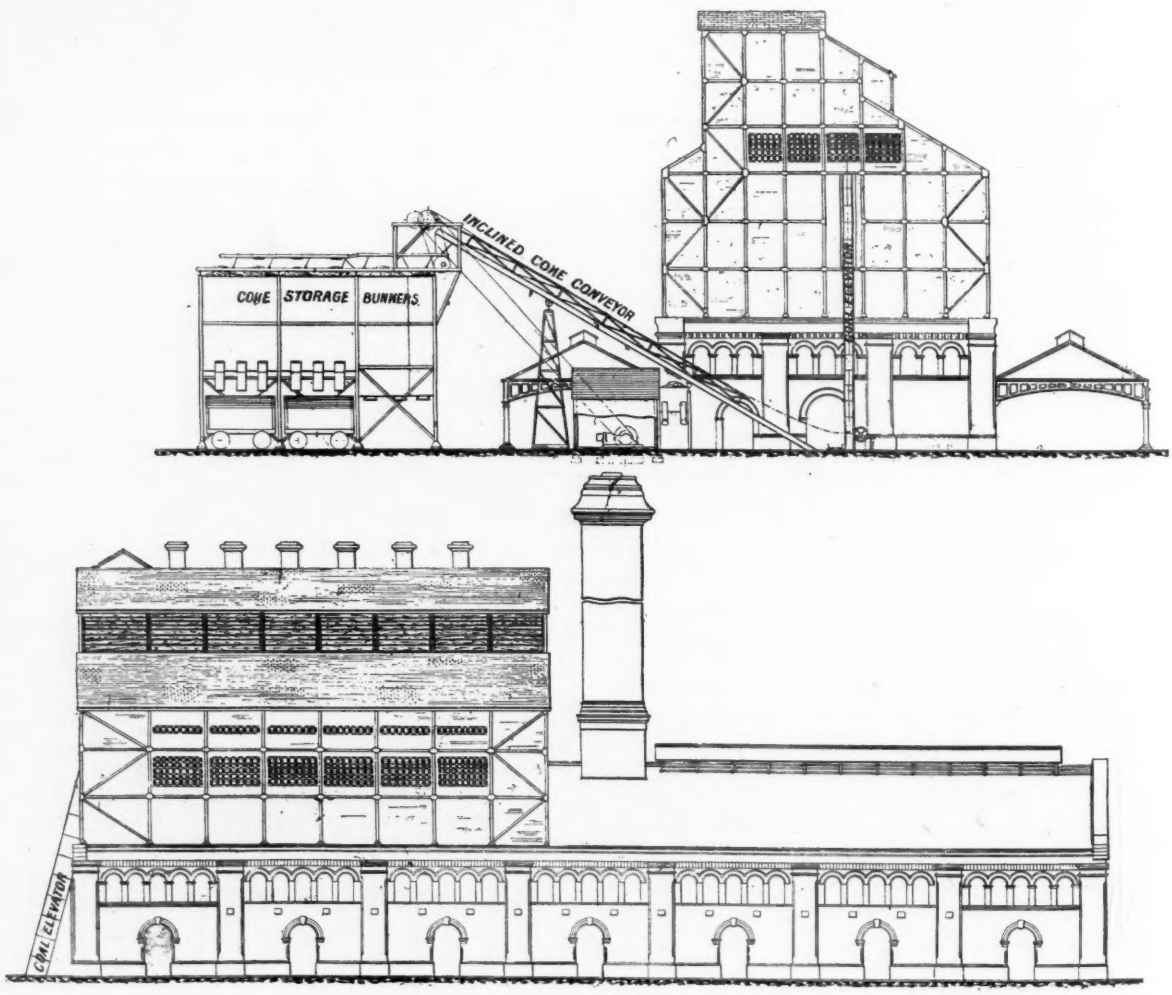


The Gable End of the Retort-House under Alteration for the Vertical Settings.

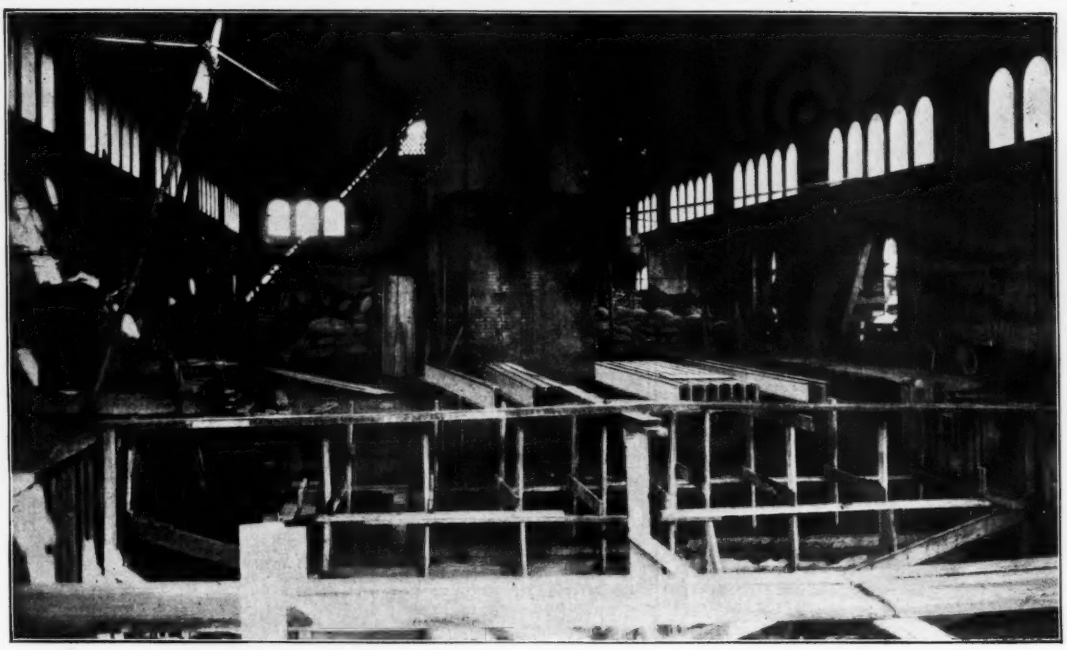
The Alterations at Nottingham—Showing the Roof and Gable of the Old Retort-House to be taken down, the Existing Scrubber, and the Openings made for the Coal and Coke Elevators and the Receiving Hoppers.



Proposed Arrangement of the Coke Plant.



Longitudinal and End Elevations of the Retort-House and Coke-Plant.



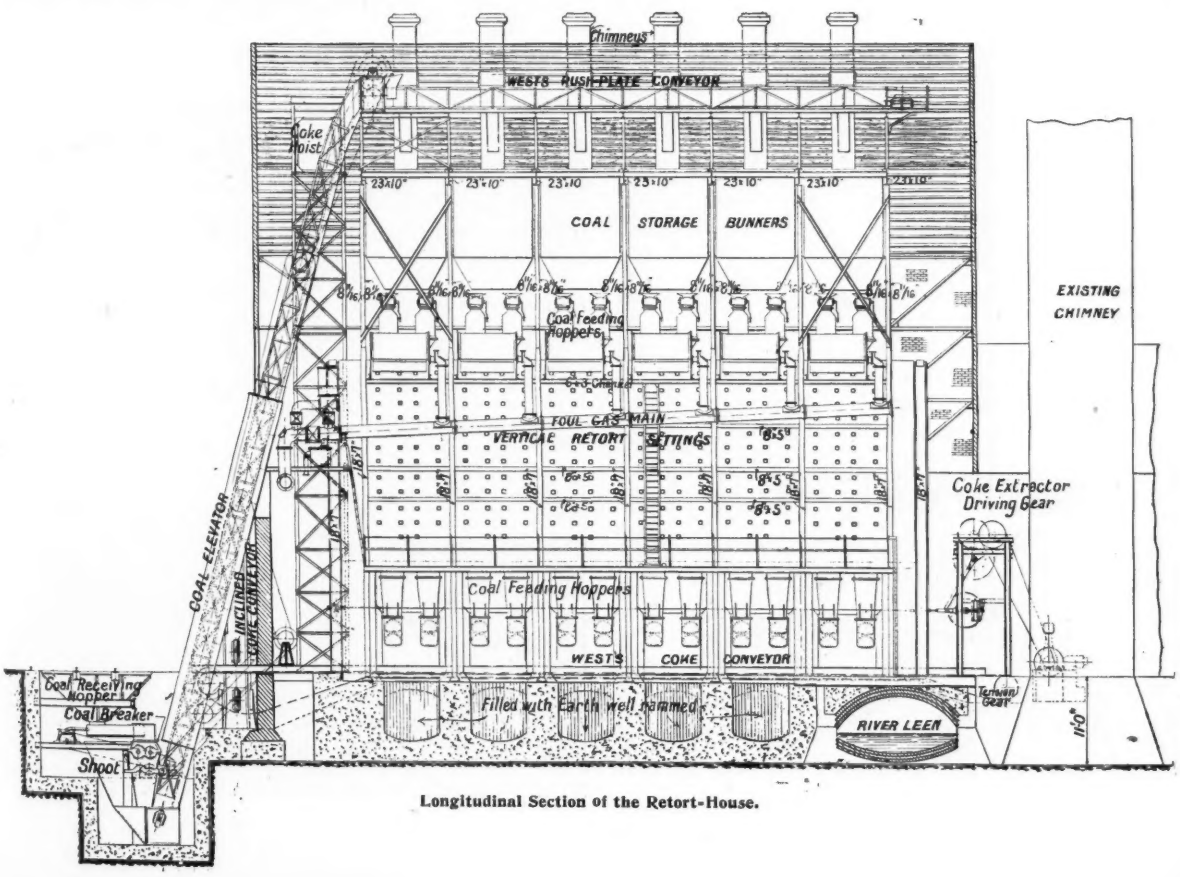
End Elevation of the Gridiron Floor in Course of Construction over the River Leen.

the oldest houses in that part of Nottingham, there is within easy distance also quite a colony of dwellings of modern type; and to the residents there the installation of the Glover-West plant, with its cleanliness of arrangement, is calculated to prove of unmistakable advantage.

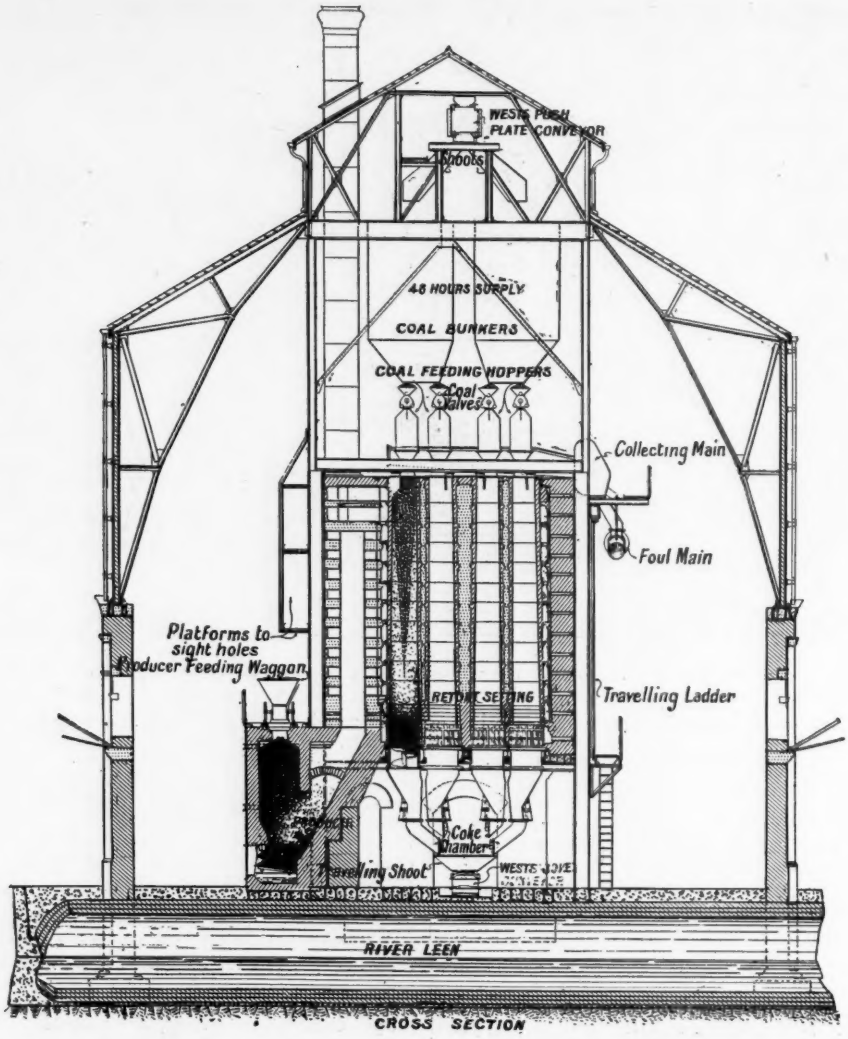
During the preliminary operations, considerable difficulty was experienced owing to the proximity of the River Leen, a diversion of which ran right under one of the benches. A running stream at an average depth of 13 feet had to be dealt with; but the trouble has been effectively surmounted by a stiffening process of ferro-concrete of gridiron formation girders. The matter, however, has been one entailing very considerable difficulty, and it is satisfactory to gather that this branch of the work has been completed with eminently sound results.

The conveyors and hoppers will necessarily represent the most up-to-date appliances. In connection with the receiving hopper, there will be a waggon-tipper capable of discharging into the receiver, by hydraulic means, ten tons of coal, representing the contents of each truck. From this point, the process of manipulation is illustrated by a sequence of interesting details. After reaching the receiving hopper, the coal passes on to a jigging screen feeding the breaker. Beneath the receiving hopper the breaker will be located, capable of dealing with coal and cannel of any size as it comes along. To enable this to be effected, the material to be carbonized traverses a feeding screen, so constructed as to enable the smaller coal to pass the breaker and go on directly to the boot of the elevator; the coal thence finding its way to the overhead bunkers, which are above the top of the bed, rendering possible the maintenance for 48 hours of a continuous supply.

The coke from the retorts is transported to a conveyor. At the gable end of the building, which points towards Wollaton Hall,



Longitudinal Section of the Retort-House.



The Arrangement of Glover-West Vertical Retorts, in Cross Section, at Nottingham.

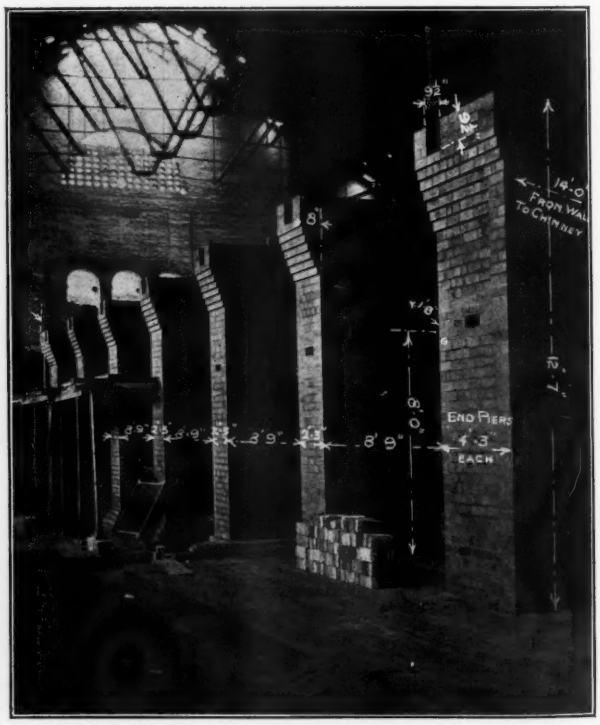
it will be raised by an inclined conveyor to the screening plant situated over large containing hoppers. The screens are divided into different sizes; the sizes of the coke being largely determined by the local conditions. The coke-hopper is capable of holding 120 tons, and is divided into a number of bunkers, that receive the coke from the screens above. The large containing hopper will be furnished with the necessary outlets for filling railway trucks on the Midland Company's line immediately contiguous to the depôt, or the carts of local traders; the railway also serving the purpose of enabling coal to be delivered at the sidings immediately over the receiving hopper. Herein the help afforded by the Midland Company has greatly facilitated the work, alterations to the sidings having been effected to enable coal and coke to be expeditiously and economically dealt with.

The power necessary for the efficient running of the several sections of the new works has been designed on ample lines. There will be a large gas-engine for driving the breaker, coal elevator, conveyor, and waggon tipper—everything dealing with the coal being driven from this one engine. There is to be a separate gas-engine installed for driving the bench coke-conveyor and coke-lift, another for the inclined conveyor and jigging coke screen; while the extractor gear will be driven by means of a small gas-engine and duplicate steam-engine fixed at the opposite end of the retort-bench.

The new settings are taking the place of nine beds of seven old-fashioned direct-fired retorts, 20-inch by 14-inch and 18 ft. 6 in. through. As in all similar installations, economy of ground space forms a notable feature.

Readiness to adopt new methods is not wanting upon the part of the Nottingham Gas Committee; but what further developments may be in store in relation to vertical retorts—apart from the Radford depôt—must necessarily depend upon experience of the new working. The figures as to cost and results attained will supply materials for careful analyses in the time that has yet to come. The considerations involved are obviously of the greatest possible significance, having regard to the fact that the gas undertaking is, far and away, the most important of all Nottingham's municipal trading departments.

All concerned are to be heartily congratulated at having in this way overcome the difficulties surrounding the construction of the verticals at Nottingham.



Completion of the Blue-Brick Pier-Walls and Foundation, ready to receive the Fire-Clay Wall for the Producers and Retorts.

WATER AFFAIRS.

Review of the Principal Events of the Year.

In accordance with custom at this season, we review the principal events in connection with the supply of water which have been recorded in the "Journal" during the past twelve months.

The Weather—Rains and Floods.

In view of the dependence of the water supply of the country upon the extent of the rainfall, attention may first be given to the general weather conditions of the year. The outstanding feature of 1911 was the abnormally hot and dry summer. This year the corresponding season was, on the whole, just the reverse. Most people would have said, if questioned on the subject, that, from their own experience, 1911 was an exceptionally dry year. Yet, according to the Director of the British Rainfall Organization (Dr. H. R. Mill), it was one of "very nearly average rainfall, with an excess above the normal amount over about one-third of the area of the United Kingdom," though he says "it was only in the last month that the balance in favour of wetness was turned in England or Ireland." The weather in that month was certainly remarkable. Colonel Chrystie, of Farnham, in a letter to "The Times" on the 2nd of January last, stated that rain had been registered on every day up to the 27th, and most days in considerable quantities. The total rainfall was 7·78 inches, which had been exceeded only once in any month in the thirteen years during which he had kept a register. At the end of September they were 5·49 inches behind; but by the 1st of December the deficiency had been reduced to 3·52 inches. The extraordinary fall in that month brought the year's total to 28·62 inches—only 1·83 inches in excess of the average at Farnham.

There was an abnormal rainfall at Oxford in the month just named, and also in January; the result being serious floods in the Thames Valley, which above Teddington comprises an area of about 3800 square miles. In an interesting communication by Dr. Mill to "The Times" on the 16th of April, he emphasized the vital importance of this large region to the inhabitants of London, inasmuch as it furnishes the bulk of their water supply. According to him, the average precipitation for the year 1911 was estimated at about 27 inches, of which 12·5 inches fell in the summer six months, and 14·5 inches in the winter similar period. Considering the year broken as near the equinoxes as the end of the months allows, and composed of the summer six months and the next following winter six months, Dr. Mill says "there has not been an instance of greater disparity between the summer and winter rainfall than in 1911-12, when from April to September there fell only 8·11 inches of rain, and from October to March 23·53 inches. The summer rainfall was 35 per cent. below the summer average, and the winter rainfall 62 per cent. above the winter average." Taking a period of twenty-nine years, the six months' rainfall of 1911-12 was greater than the entire fall in seven of the years.

The outstanding feature of the year, however, was the extraordinary weather that prevailed in the month of August, when rain fell in London on twenty-five days out of thirty-one. Compared with 1911, there was in this period sunshine for only 68 hours, against 215 hours in the corresponding month; while the rainfall was 4 inches, as against 0·94 inch. While the effect of the abnormal rainfall was felt generally, it was East Anglia that suffered most. On the 26th of August, rain began to fall in Lincolnshire shortly after seven o'clock in the morning; and its intensity increased rapidly over the whole area. The maximum was reached in a fall of 4 inches in four hours (from 11 a.m. to 3 p.m.) in the neighbourhood of Norwich. According to some statistics furnished by Dr. Mill, in a paper read before the Royal Meteorological Society, the quantity of rain which fell in the 24 hours of the day named was 3·66 inches in Suffolk and 5·08 inches in Norfolk—representing in volume 78,805 million and 150,242 million gallons respectively, or equivalent to 351·8 million and 670·7 million tons. The neighbouring counties of Huntingdon and Cambridge also suffered, but less seriously. Nevertheless in the former there was a fall of 2·27 inches and in the latter of 2·66 inches of rain—representing respectively 12,012 million and 33,134 million gallons, or equivalent to 53·6 million and 147·9 million tons. The greatest long-continued widespread rain on record for any part of the British Isles only produced half the volume of the fall in East Anglia; and only two instances could be found—viz., July, 1875, and November, 1878—when the rainfall of an entire month surpassed that of these 24 hours. Dr. Mill stated that the cause of the prolonged torrential downpour was not to be found in the physical geography of the district affected, but in the meteorological conditions, for the full elucidation of which the data available were insufficient. Considering the unprecedented magnitude of the volume of rain precipitated, the floods were, he said, remarkable rather for their moderation than for the destruction they wrought. In his opinion, the Norwich rainfall on the memorable day named will, of itself, give the present year a unique place in the history of English floods; and when the records of all the stations in the country have been discussed, it seems not unlikely that August also may be branded as unprecedented.

Position and Work of the Water Board.

The Metropolitan Water Board resumed their sittings after the Christmas recess on the 26th of January; but nothing specially noteworthy occurred until the meeting on March 22, when the members had before them a report by the Finance Committee, giving the results of an investigation by them, extending over more than two years, into the financial position of the Board. The Committee had to compare the undertaking with its position under the Water Companies, and give the Board such information as might enable them to judge whether an equilibrium as between income and expenditure was or was not likely to be attained in the near future. The conclusion arrived at by the Committee was that there was not only no possibility of such equilibrium being attained, but that "deficiencies would occur for many years to come." Down to March 31 last, these had averaged £50,000 per annum. The total at the corresponding date in 1911 was £135,835; and it was estimated that this figure would be increased to £200,000 by the end of the last financial year. What was to be done in the circumstances? The Committee were strongly of opinion that efforts should be made to avoid levying a deficiency rate, and that Parliament should be asked to review the situation, with a view to new provisions being enacted upon a more simple and equitable basis than those in existence. The Board were asked by the Committee to declare that fresh legislation was expedient, and that the Local Government Board should be interviewed on the subject, so as to arrange for the introduction of an amending Bill. The report was received, and the matter was left.

The financial position of the Board was again brought to the attention of the members at the meeting on May 31, when the estimates for the year 1912-13 were presented. They showed a total income on revenue account of £2,905,480, and an expenditure of £2,980,070—leaving an anticipated deficiency of £74,590. In the course of the remarks of the Chairman of the Finance Committee (Mr. A. H. Tozer), when moving the adoption of the estimates, he mentioned that the ascertained deficiencies up to March 31, 1911, and the approximate deficiency for 1911-12 made a total of £207,215, or £7215 more than was estimated by the Committee in their report. He expressed the hope that the efforts of a Special Committee, then recently appointed with a view to obtaining suitable legislation with regard to the Board's charges, would result in placing the income upon such a basis as would secure a sufficient margin to enable them to cover their expenditure, and make provision for heavy payments which would fall due in the year 1923-4, and thereafter in respect of their hundred-year debt. The estimates were received; but nothing further was done. The report of the Special Committee was presented at the last meeting of the Board before the summer recess; and their recommendation that a Bill should be prepared to carry out their proposals was adopted, though an amendment was moved calling upon the Finance Committee to issue precepts upon the constituent authorities, as provided by the Metropolis Water Act, 1902.

The deficiency question came up again at the meeting of the Board on the 15th ult., when the Law and Parliamentary Committee recommended the promotion of a Bill containing provisions for the levying of a rate-in-aid. They explained that the proposed Bill would relate to about £210,000; and they pointed out that before it became law the amount might be £300,000. The Committee recommended that provision should be inserted permitting of the liquidation of the deficiency being spread over a short

term of years, and that the Board should be empowered to borrow for the purpose. The Chairman of the Finance Committee said he estimated that by 1914 the deficiency would reach £350,000. No decision was come to; and, pending it, notice of a Bill was duly given. At the next meeting of the Board, however, the proposed measure was adversely criticized; it being contended that it would relieve London and Westminster from obligations which had been imposed upon them by Parliament. The Finance Committee were charged with having been guilty of neglect in not levying a deficiency rate. The Chairman of the Committee admitted that the City would get some relief under the Bill. While, however, certain boroughs would have to pay less, others would pay more; but the amounts would be trifling. After some discussion, the recommendation to promote the Bill was defeated by two votes. At the meeting of the Board on the 13th inst., it was decided to issue precepts for a deficiency rate equal to 0·9d. in the pound.

Turning from the efforts of the Board to set their finances upon a more satisfactory basis, it will be of interest to review their work during the year as controllers of probably the largest water undertaking in the world, and see what they are doing to meet the ever-growing demands upon them. It will no doubt be remembered that in the session of 1911 they went to Parliament with a large scheme for the construction of storage reservoirs in the neighbourhood of the Thames. Their several proposals were submitted to searching inquiry by a Joint Committee of the two Houses, under the presidency of the Earl of Kintore. In the result, the scheme, which provided for the construction of eight reservoirs, calculated to supply water to London till 1941, was so curtailed that the Board at first decided to withdraw what was left of it, and go to Parliament again. Subsequently, however, they reluctantly agreed to accept the conditions imposed by the Committee. This was the position at the opening of the present year. The Works and Stores Committee, however, had under consideration a scheme for the provision of future supplies of water; and a report thereon was submitted to the members when they were asked to pass the estimates for the year 1912-13. The Finance Committee had had the report before them; and the Chairman intimated that the scheme would involve an expenditure of from two to three millions of money. By the Board's New Works Act of 1911, they were empowered to construct three additional reservoirs—one at Stanwell and two at Littleton. It was not intended that they should all be built at once, but be undertaken when necessary. As the result of a conference with the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) and the Deputy Chief Engineer (Mr. J. W. Restler, M.Inst.C.E.), and the consideration of reports by them, the Committee submitted a scheme for increasing the supply of water in the area north of the Thames. Full details of it were given in the report; and the Committee said it had their entire approval. They recommended that they should be instructed to submit plans and estimates of the proposed works, and that the Law and Parliamentary Committee should be asked to report as to what additional powers were required by the Board in connection with the project. At their meeting on the 14th of June, the Board sanctioned the construction of two reservoirs (each capable of containing 3500 million gallons of water) and 15 acres of filter-beds, at a cost of approximately £1,646,400. In addition to the large scheme just referred to, for which parliamentary sanction is being sought, the Board have quite recently decided to provide additional works in the Kent district, at a total estimated cost of £89,395, including a new well and pumping machinery and a new main. Extensions are to be carried out in other parts of London. As the result of protracted negotiations and arbitration proceedings, the Board came to an understanding with the London County Council in regard to meeting the cost of improvements to be made in the arrangements for the supply of water for fire extinction.

With the continued growth of their operations, as shown by their successive annual reports, the latest of which, for the year ended the 31st of March last, was noticed in the "JOURNAL" a few weeks ago, the Board are feeling the inadequacy of their offices at Savoy Court, and they have under consideration a proposal to acquire King's College Hospital for conversion into central offices suitable for the accommodation of the staff, who are now located in different parts of London. For example, the Water Examination Department—so ably controlled by the Board's Director of Water Examination (Dr. A. C. Houston), whose elaborate periodical reports bear testimony alike to the thoroughness of his work and the strict watch kept upon the quality of London water—is housed in the offices of the old West Middlesex Water-Works Company in Marylebone Road. Some members of the Board favour the erection of a building on the Board's land in Rosebery Avenue; but the acquisition of the hospital is considered preferable.

THE BOARD'S LITIGATION.

It is only to be expected that, in carrying on so vast a business as that of supplying water to the inhabitants of the Metropolis—numbering close upon 7 millions—the Water Board will from time to time be engaged in litigation, in order that they may not be deprived of the rights which have been conferred upon them by Parliament. Several cases have occurred during the year which call for notice. The question of the supply of water to separate tenements came before his Honour Judge Woodfall, at the Westminster County Court, early in the year. A firm of Solicitors had offices on two floors, and used the water on both, although the only means of obtaining it was a tap on one floor. The Board claimed, under section 8 of their Charges Act, the rate based upon the rateable value for both floors; and his Honour upheld it, as he did in a similar case in which a City firm were concerned.

Towards the end of March, Mr. Justice Horridge and a Common Jury had before them a claim made by a clothier and outfitter in the Essex Road, Islington, for damage caused to his premises through the bursting of a water-main, as alleged, through the negligence of the Board's servants. It was contended that the Board had neglected their duty in not having the main sufficiently inspected; and the question left to the Jury was the responsibility of the defendants. They decided that the burst was not occasioned by a pre-existing fracture in the pipe, but by some other cause; and that the defendants could not have been reasonably expected to discover it. Judgment was accordingly given for them, with costs. The Board were defendants in an action of a similar character brought in the Shoreditch County Court by a publican at Hackney Wick, whose beer-cellar had been flooded. The plaintiff thought the main was rotten; but one of the Board's servants attributed the burst to the frost, which was very severe at the time. The main was laid about 3 ft. 6 in. below the pavement; and his Honour thought it was hardly likely to be affected by frost. But even supposing the pipe to have been defective, as alleged by the plaintiff, it rested with him to prove that the Board knew it to be in this condition. There was no case, and consequently judgment was given for the defendants, with costs.

The Judge at the Westminster County Court had before him a case in which the Board summoned a consumer for 10s. for water used in his garden. The defence was that the water was waste from a bath; and it was submitted that this could be utilized in the way stated without the user being liable for an extra charge. The Board's Solicitor said it was a case of the use of domestic water for a non-domestic purpose. He admitted that the point was a nice one. His Honour gave judgment for the plaintiffs, with costs; but he said that in so doing he did not decide the case on the question of the use of waste water.

The rating of licensed premises for water supply was the subject of some further litigation between the Board and the occupier of a tavern in Aldersgate Street. The action was originally brought before Mr. Justice Parker, towards the close of last year, to obtain a declaration that, on the true construction of the Board's Charges Act, the water-rate of the tavern for the quarter ended Dec. 31, 1910, should be calculated on the rateable value of £400, according to the valuation list in force at the commencement of the quarter, and that the occupier was liable to the payment of £5 (being 5 per cent. on £400) for the quarter named, and £2 18s. 6d., based upon a provisional assessment subsequently made, for the quarter from Jan. 1 to March 31, 1911. It was contended for the defendant (Mr. Raphael Phillips) that the rate for both quarters should be the lower amount. The question of liability turned upon the construction of section 13 of the above-named Act, which sets forth that the rateable value of any house or building is to be determined "by the valuation list in force at the commencement of the quarter for which the rate accrues, or, if there is no such list in force, by the last rate made for the relief of the poor, or other rate in which the last-mentioned rate is included." Mr. Justice Parker came to the conclusion that the list re-

ferred to in the section was the original list in existence on the first days of the water quarter, unaltered by any provisional list, unless the latter had then been completed, after any objection had been taken before the Assessment Committee and been determined upon by them. He accordingly gave judgment for the Board, with costs. From this decision the defendant appealed; and the question duly came before the Master of the Rolls and Lords Justices Farwell and Kennedy early in July. The Master of the Rolls considered that Mr. Justice Parker was right; his two colleagues, however, held the contrary opinion. The appeal was accordingly allowed. In these circumstances, the judicial opinion in the two Courts being equally divided—the Board took the case to the House of Lords, where the Lord Chancellor and Lords Atkinson, Shaw, and Mersey were engaged upon it for two days. The arguments of the respondent's Counsel (Mr. Ryde, K.C.) turned entirely upon sections of Acts of Parliament cited with a view to showing that, if the dispute had been in reference to a claim for poor-rate, the order of the majority of the Court of Appeal was right, and should be affirmed. Mr. Balfour Browne, for the respondents, contended that all charges in the supplemental or provisional list, whether up or down, were future, and not retrospective, relative to the list in force at the beginning of the quarter for which the water-rate accrued. At the close of the arguments, their Lordships reserved their judgment, which was delivered on the 18th ult. The Lord Chancellor said it seemed to him, for the reasons given by Mr. Justice Parker, and approved by the Master of the Rolls, that the assessment fixed in the list dated Oct. 3 did not relate back to Oct. 1, and the appeal should, therefore, be allowed, with costs. The other learned lords concurred; and the decision of Mr. Justice Parker was accordingly restored.

The question at issue in the case above summarized was regarded by the Licensed Victuallers' Central Protection Society as being of such general importance to the "trade" that they took up the matter. They also decided to support two defendants in actions brought by the Board to recover from each of them the sum of 5s., the equivalent of two quarters' water-rate on the non-domestic scale in respect of certain licensed premises in the neighbourhood of the Minories. At the house kept by one of the defendants, a Mrs. Avery, catering was carried on—about thirty luncheons being served every day; and the charge was made in connection with water used for cooking, drinking, the washing of utensils, &c. It was submitted that catering had been done ever since the house was licensed, and the owner had never been charged anything beyond the amount of the ordinary water-rate. It was contended that, though the house was conducted for the purpose of a trade, the water supplied to it came within the definition of "domestic purposes." The action was tried at the Westminster County Court, and his Honour Judge Woodfall said he thought his decision must be for the plaintiffs. At the same time, the point raised was so important that he considered an authoritative pronouncement should be obtained upon it by a Higher Court. He expressed the opinion that the plaintiffs were entitled to claim a reasonable sum under section 18 of the Water-Works Clauses Act, 1863; and he gave judgment, under this section, for the amount in question. He also gave leave to appeal; and, pending the result, the other action was not proceeded with.

The period within which water-rates can be recovered was a question raised in an action brought by the Board, in the Westminster County Court, against the owner of three houses at Brixton. The rates were due down to the quarter ended Sept. 30, 1908; so that a period of more than six months had elapsed after the last rate became due and before the action was brought. The Judge had decided against the Board on a preliminary objection to the claim; and they appealed. The arguments on both sides were heard by Justices Ridley and Scrutton on the 26th ult.—Mr. Clavell Salter, K.C., M.P., appearing for the appellants, and Mr. Macmorran representing the respondent (a lady), who was sued as successive or subsequent owner of the premises in question, and whose liability was not questioned on any other ground than the limitation of six months. Mr. Salter submitted that the respondent was liable unless she could show that every action against a successive owner must be brought within six months. The rates were due under two Acts, and the points to be determined arose under several. Mr. Macmorran contended that where a Statute gave a summary remedy for the recovery of money, and a subsequent Act gave an alternative civil remedy for the same amount, the period of limitation prescribed with regard to the former remedy applied also to the latter. If the Board elected to proceed by the summary remedy, they were bound by the six months' limitation. The respondent had paid all the water-rates since she became owner of the premises, and the others were due before that time. Their Lordships did not think the decision of the County Court Judge could be supported; and they sent the case back to him, to hear and determine it, with the expression of the opinion of the Divisional Court that the six months' limitation did not apply. But they gave leave to appeal.

In another Divisional Court, Justices Channell and Avory were divided in opinion on the subject of the legality of a claim made by the Board against a firm of builders who were carrying out some works at Hounslow Barracks. The action was originally brought in the Westminster County Court in the following circumstances: Defendants, under a contract with the War Office, erected a building at the barracks; and it was a term of the contract that the water for use in the operations should be supplied free of charge—the water being measured by the meter in the ordinary course, and paid for by the War Office. The Board, under section 17 of their Charges Act, claimed the sum of 15s.—being at the rate of 7s. per cent. on the probable cost of the building; and it was allowed. Thereupon the defendants appealed. Mr. Justice Channell thought the defendants were not persons who required a supply of water within the meaning of the section; and therefore the action was not maintainable. Mr. Justice Avory, on the other hand, considered that the meaning of the section was that a builder who needed water for his operations must make a request for it to the Board, and pay the special charge. As their Lordships differed, the appeal was dismissed; but leave to appeal further was granted.

Mr. Edward Pollock, one of the Official Referees, was engaged for several days towards the close of the year in hearing an action brought by Messrs. Pethick Bros., of Plymouth, against the Board, to recover a sum of £16,121, the balance alleged to be due to them in respect of their contract for the construction of reservoirs and filter-beds at Long Ditton, Surrey. The circumstances which gave rise to the claim are set forth in the report which appears elsewhere. Owing, as alleged by the defendants, to want of due diligence on the part of the plaintiffs, they had to determine the contract, and have the works completed by other firms. They denied that a sum of £16,121 was due to the plaintiffs; but they expressed their willingness to credit them with £12,223, against a counterclaim of £13,617—leaving £1394. The Referee gave judgment on the 20th inst. on the legal arguments raised in the case. He held that the Board were quite justified in determining the contract, and that the plaintiffs had failed to sustain their contention that they had suffered considerable loss thereby. The financial questions involved in the action are to be considered at a future hearing.

Schemes of Improved Water Supply.

The year now closing will not be conspicuous for the completion of any very large schemes of water supply, with the exception of the section of the Derwent Valley works which was inaugurated early in September. These works, it may be remembered, have been designed to meet the wants of Leicester, Derby, Sheffield, and Nottingham; and a sum of £3,250,000 has already been expended upon them, with the probability of very nearly an equal amount being required before their completion. The works have been fully described, and portions of them were illustrated, in the "Journal." The inaugural ceremony took place in the Peak County, where the Howden Dam has been constructed; and it was performed by Sir Edward Fraser, D.C.L., of Nottingham, who was then the Chairman of the Board specially constituted for carrying out the scheme, and who was presented with a silver model of the dam as a memento of the occasion. It had been hoped that their Majesties the King and Queen might have attended the opening ceremony; but Royal engagements elsewhere precluded the possibility of their accepting the Board's invitation. In the course of the congratulatory speeches, reference was made to the innumerable difficulties which had been surmounted through the skill of the Engineer of the scheme, Mr. Edward Sandeman, M.Inst.C.E., who made the gratifying announcement that the actual expenditure on it up to date had been kept within some £60,000 of the estimates. A supply of water from the Derwent works

was turned on at Ripley on the 6th ult. by Mr. E. J. Ellis-Fermor, the Chairman of the Urban District Council, and the quality was pronounced excellent.

The official opening of the Kinder Water-Works, which have cost the Stockport Corporation upwards of half-a-million sterling, took place in the summer, in the presence of a large company. The Chairman of the Water Committee (Alderman Albert Johnson) first turned on the water from the new reservoir, and then the Mayor (Alderman A. Briggs) opened the installation of mechanical filters. Great difficulties had been experienced in carrying out the works, owing to the bad foundations and the open beds of shale and rock met with in the valley. The reservoir, which was commenced in 1902, has a capacity of 515 million gallons, and covers an area of 44 acres. Provision has been made for dealing ultimately with 5 million gallons of water daily. The area supplied by the Corporation is about 80 square miles, with a population of 171,000. Almost simultaneously, the completion of the new water scheme for the supply of Lincoln was marked by the Mayor (Mr. J. Mills) turning on the valve at the Bracebridge Heath reservoir. The Water Engineer of the Corporation (Mr. N. M'K. Barron) explained that the reservoir would hold 6 million gallons, or 3½ days' supply for the city, and had cost £27,000. By the construction of the works at Elkesley Moors, of which the reservoir is a part, the Corporation have, at an expenditure of £235,000, ensured an ample supply of water.

Earlier in the year, the extensions which had been carried out in the water-works of the Stafford Corporation were brought into use by the Earl of Lichfield, from whose estate the supply is obtained, turning the water into the rising main. This was followed by the Countess of Lichfield starting the pumping machinery, which has been greatly improved. The extensions were designed by Mr. W. Plant, Assoc.M.Inst.C.E., the Borough Engineer and Water-Works Superintendent, under whose direction they were carried out. The population supplied is about 27,000; and the quantity of water raised at the pumping-station in the twelve months ended the 31st of March last was 240 million gallons. The new machinery will raise 1400 gallons per minute; the maximum lift being 280 feet. The reservoir has a capacity of 577,000 gallons, or about a day's average supply. Through the kindness of another member of the aristocracy—the Earl of Plymouth—Ludlow has been provided with a new water supply, which was formally brought into use early in March; the inaugural ceremony being performed by his Lordship. The scheme was designed by the Borough Surveyor (Mr. J. A. Spreckley); and in connection with it the Town Council secured the services, as expert, of Mr. H. P. Maybury, the County Surveyor of Kent, who formerly had the engineering supervision of all the municipal works of the Great Malvern Urban District Council. On the 26th of February, the Lord Mayor of London (Sir Thomas Crosby), who was accompanied by the Lady Mayoress, paid a visit to Gosberton, Lincolnshire, his native place, and opened the new works of the Donnington Water Company. In July, the scheme of the Ruthin Rural District Council for supplying water to most of the parishes on the north-eastern side of the Vale of Clwyd was inaugurated by Mrs. Humphreys Roberts, wife of the Clerk to the Council. Shortly afterwards, the water-works supplying the First Garden City, at Letchworth, were extended by the construction of a second reservoir of 500,000 gallons capacity, which was opened by Colonel F. S. Bowring, C.B. The growth of the "city" had necessitated the sinking of additional boreholes; and consequently more storage was needed. It was stated that the supply of water was practically unlimited. About the same time, the Duke of Portland opened the extensive water-works constructed for the supply of Troon and the neighbourhood, having a population of 30,000. The principal sources are Lochs Bradan and Lure, about thirty miles from Troon; and it was estimated that there would be a net available supply of 2¼ million gallons a day, even in a succession of the driest seasons. Early in August, new water-works for Exmouth were formally opened by Lady Clinton. The source of supply is at Dotton, about eight miles from the town, and five miles from the reservoir at Squabmoor, from which the water is mainly drawn. Messrs. G. H. Hill and Sons were the Engineers of the scheme, which was carried out under the direct supervision of Mr. S. Hutton, the Surveyor and Water Engineer to the Urban District Council.

Other schemes have been carried out, commenced, or are projected for improving the supply of water to the following places: Aberdeen, Abertillery, Adelaide (South Australia), Ashton-under-Lyne and district, Bedford, Bideford, Birkenhead, Blackburn, Brighouse, Buenos Ayres, Bury, Cardiff, Chapel-en-le-Frith, Chorley, Coventry, Diss, Epsom, Flanders, Genoa, Glasgow, Gourock, Howden (Yorks.), Invergordon, Kingscliffe, Llanelly, London (South-West Suburban Company's district), Looe, Lostwithiel, Manchester, Northampton, Northumberland (East), Nuneaton, Oldham (from colliery workings), Perranporth, Pershore, Porthcawl, Ribchester, St. Petersburg, Shrewsbury, Southampton, Stourport, Thorne, Topsham, Torquay, Wakefield, Warrenpoint, Western Valleys, and Widnes. Early in the year, the two great divisions of the Catskill aqueduct tunnel under the Hudson River, in connection with the new works for the supply of New York, were united. The system, which is expected to be completed next year, will provide the city with an additional 500 million gallons of water daily. Purchase proposals have arisen or have been carried into effect in connection with Cowdenbeath, Felixstowe (rejected), Kingston, Staffordshire Potteries, Tavistock, and Ticehurst.

During the year, the Local Government Board have held inquiries in respect of the water supply of the following places: Alnwick, Bacup, Bakewell, Barnsley, Bettwys-y-Coed, Bideford, Bolton, Cheltenham, Doncaster, Dunmow, Earls Colne, Fylde, Ilkley, Lancaster, Long Eaton, Northampton, Petersfield, Rhyl, Rochford, Rotherham, St. Ives, St. Neot (Liskeard), Shoeburyness, Silverton Snaith, Southampton, Stourport, Talkin, Walton-le-Dale, Warrington, and Westmorland. In the course of an inquiry held at Haslingden, testimony was borne to the value of the services of a water diviner. The Local Government Board sanctioned the purchase by the Spalding Rural District Council of the portion of the South Lincolnshire Water Company's undertaking which is within the Spalding Union.

Water Legislation.

The water legislation of the year has been so recently noticed, that only brief reference to it is necessary here. Taking the companies first, the Dunstable Gas and Water Company obtained parliamentary sanction for the construction of their existing works, authority to erect another pumping-station, a service reservoir, &c., and permission to raise more capital. Similar powers were granted to the Staffordshire Potteries Water Company, with an extension of limits. The Swanage Gas and Water Company have obtained authority to construct additional works and raise more capital; and in their Act provision is made for the transfer of the water undertaking to the Urban District Council. Another prospective transfer is that of the undertaking of the Windermere Gas and Water Company.

The water schemes of local authorities were rather more numerous. The Bedwellty Urban District Council obtained power to purchase a portion of the water undertaking of the Rhymney and Aber Valleys Gas and Water Company, extend their water limits, and raise additional capital. The Belfast City and District Water Commissioners were granted an extension of time for the construction of certain works, given permission to raise more capital, and authorized to subscribe to the funds of any society "having for its object the scientific study of water supply." The Church Stretton Urban District Council obtained authority to purchase the undertaking of the Church Stretton Water Company, Limited, supply water within the parishes of Church Stretton, Little Stretton, and All Stretton, in the county of Salop, and raise the necessary money. The Derwent Valley Water Board were allowed more time within which to purchase certain lands compulsorily. The Dover Corporation may now enter into agreements with the East Kent District Water Company with reference to the rates to be charged for water in the portion of the borough included within the statutory limits of the Company. The Egremont Urban District Council have been authorized to construct and maintain works and supply water in their district. The Fylde Water Board have been empowered to carry out an extensive scheme of new works, for the completion of which twenty years have been granted; and they may borrow nearly £1,500,000 in connection therewith. Authority to construct additional works has been given to the Ivybridge Urban District Council and to the Keighley Corporation; the Llanelly Rural District Council may take a supply of water from the River Sawdde and build new works; the Neath Rural District Council have

obtained an extension of time for the construction of works authorized by the Ystradfellte Water Act of 1902; and the Scunthorpe Urban District Council are authorized to make further provision for the supply of water in their district, the limits of which are extended. Further powers have been granted to the Swansea Corporation in respect of their water-works undertaking; and the Tavistock Urban District Council have obtained authority to acquire, by agreement, the water undertaking of the Duke of Bedford.

It is a rather curious feature of the water legislation of the session that the measure which came into probably the greatest prominence was the Provisional Order of the East Surrey Water Company. It was to confer upon the Company additional powers, and it was strongly opposed by the Croydon Corporation and millowners and others interested in the River Wandle, on the ground that they would be affected. After passing through a Committee of the House of Lords, the Order encountered considerable opposition in the Commons, where several attempts were made to have it rejected. The Select Committee to whom it was referred passed it; but when it later came before the House for consideration, an attempt was made to have a compensation clause inserted. This, however, was defeated. The opponents made a last stand at the third reading stage, but with no better success. The Confirming Bill containing the Order was passed, and it received the Royal Assent on the 13th inst.

Early in July, a Bill was introduced by Mr. Herbert Lewis, the Parliamentary Secretary of the Local Government Board, to enable the Board, by Provisional Order, to give powers to local authorities for the purpose of the acquisition of water; but the measure awaits second reading.

Legal Proceedings.

The general legal business in connection with the supply of water has not presented many striking features; but the cases which have arisen have been sufficiently interesting to call for notice in reviewing the events of the year.

The question of damage caused to roads through main-laying operations came before the Lord Chief Justice and Justices Pickford and Avory early in the year, on a case stated by the Justices of the Peace for the petty sessional division of Ystradgynlais. It arose from a complaint by the Surveyor to the Brecon County Council that the Corporation of Swansea had, as the result of laying a main, so damaged a road that a portion of it gave way and fell into an adjoining river. The road was repairable by the Council, and they claimed compensation for the damage done, under section 28 of the Water-Works Clauses Act, 1847. The Corporation submitted that the damage, even if caused by their operations, did not come within the section cited; and that, even if compensation were payable under it, section 85 of the Act, dealing with the recovery of damages not specially provided for, did not empower the recovery of compensation, and also that the section which incorporates section 140 of the Railways Clauses Consolidation Act, 1845, did not give the Justices any jurisdiction to deal with the complaint. The Justices found that the damage was caused by the Corporation, and they ordered them to refund to the Council the amount (£87 10s.) paid by them for the repairs. The main question for the Court was whether the damage came within section 28; and their Lordships decided that it did, and dismissed the appeal, with costs. They, however, gave leave to appeal further. The Corporation took the matter to the Court of Appeal, where it was duly considered by Lords Justices Vaughan Williams, Fletcher Moulton, and Buckley. Lord Justice Fletcher Moulton, in his judgment, said that the Corporation were not liable for damage unless it was caused through some neglect or default on their part. In the present case, it was due simply to the fact that the pipe was in the road; it was not done "in the execution of the powers" of the appellants within the meaning of section 28. Further, he did not consider the Justices were the proper persons to whom to apply for the enforcement of a claim to recover damages. The appeal must therefore be allowed, with costs. The other Lords Justices gave judgment to a similar effect.

Justices Darling and Bucknill had to decide a dispute between the Corporation of Plymouth and a consumer residing beyond the borough, but within the water limits, as to the charge to be made to him for a supply. The Judge at the Plymouth County Court had decided that the consumer (the appellant) was not entitled to demand a supply of water under section 22 of the Corporation Act of 1867; and he claimed that he had a right to it under section 53 of the Water-Works Clauses Act, 1847, on tendering the amount due under the section cited of the Special Act. Mr. Justice Darling thought he was wrong in this. What he had to do was to tender the water-rate payable according to the provisions of the two Acts, which must be read together. Section 15 of the Special Act provided that the Corporation might supply any person within the water limits beyond the borough on such terms and conditions as should be agreed upon. The appellant lived beyond the borough, but within the limits of supply; and therefore section 15 applied. His Lordship said there was no reason why this section should not be read with the Act of 1847. The appellant wished to incorporate into that Act section 22 of the Special Act because it would give him cheaper water, and to leave out section 15 because it gave him dearer water. The latter section, however, was the one that applied; and the County Court Judge was right in holding that the Corporation were not bound to supply the consumer at the rate provided in section 22, but could do so under an agreement into which they had always been ready to enter. Mr. Justice Bucknill concurred. The judgment of the Court below was consequently upheld, and without Counsel for the Corporation being called upon.

Mr. Justice Hamilton had before him an appeal of the Wakefield Rural District Council against the income-tax assessment in regard to alleged profits on their water undertaking. The appellants supply a large number of places with water bought from the Wakefield Corporation. In some there was a profit; in others, receipts balanced expenditure; and in the rest there was a loss. The point for the decision of the Court was whether the net profit on the whole undertaking was chargeable, or whether, as contended on behalf of the Commissioners of Inland Revenue, the profits made were chargeable without regard for the losses sustained. Delivering judgment, his Lordship remarked that the Commissioners had found that the water undertakings of the several parishes were really separate concerns; but his idea was that they were one. He could not accept the view of the Solicitor-General that the tax should be allocated between the parishes that showed a profit. The appeal of the Council was accordingly allowed, with costs. The Surveyor of Taxes appealed against this decision, and the arguments were heard by the Master of the Rolls and Lords Justices Farwell and Kennedy. Their Lordships were all of opinion that the Council ought to pay income-tax for each contributory parish in which a profit was made, and debit the amount against that particular parish. They therefore allowed the appeal, with costs.

Towards the close of last year, the well-worn question of the supply of water to workhouses engaged the attention of Mr. Justice Eve in the Chancery Division of the High Court of Justice, in an action brought by the Bristol Guardians to obtain a declaration that, under the Bristol Water-Works Act, 1862, their workhouses and buildings in the parish of Bristol were entitled to a supply of water for domestic purposes at the rates prescribed in the Act, and not by meter. The defendants (the Bristol Water-Works Company) said that none of the premises in question were "dwelling-houses" within the meaning of the Act; and also that, as in April, 1905, the Guardians agreed with them to pay for the water at the price of 1s. per 1000 gallons, this agreement was still binding upon them. It appeared, however, that the agreement had not been sealed. Plaintiffs claimed that they were entitled to a supply of water for domestic purposes calculated at a percentage, on scales named in the Act, on the annual gross rateable value of the premises. His Lordship said the dispute turned upon the provisions of defendants' Act that water was to be supplied at certain rates to the "owners or occupiers of private dwelling-houses;" and the conclusion he had come to was that it would be impossible to hold that an institution such as one of those in question was what would answer generally to the expression "private dwelling-house." He therefore decided that the plaintiffs had failed, and dismissed the action, with costs. The Guardians, however, were still of opinion that they were right; and they gave instructions to their Clerk to enter an appeal. This was heard by the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley early in March. The arguments extended over two days; and at the close their Lordships reserved judgment, which was delivered a few weeks later. The Master of the Rolls agreed with Mr. Justice Eve, and thought that the appeal should be dismissed, with costs;

and Lord Justice Buckley concurred. Lord Justice Fletcher Moulton, however, as the result of his examination in great detail of the various sections of the Company's Acts, particularly of the charging section of the Act of 1862, came to the conclusion that the appellants were entitled to the declaration for which they asked, and to have judgment. The majority of the Court being against the Guardians, the appeal was dismissed, with costs.

The question of the supply of water to separate houses came before the Lord Chief Justice, Mr. Justice Pickford, and Mr. Justice Avory on an appeal by the South-West Suburban Water Company against a conviction for an offence against the Water-Works Clauses Act, by refusing to furnish a supply of water to seven houses at Southall. The respondent was the owner of the houses in question, which had hitherto been supplied with water by one service-pipe. As they were of the annual value of more than £10, the owner was not bound to pay the water-rate; but as it was not paid by either the owner or the tenant, the Company cut off the water, whereupon the owner sent a cheque for the amount, and demanded that the supply should be restored. But the Company refused to reconnect unless a service-pipe was provided for each house; and on the owner taking proceedings against them, the Justices convicted, but stated a special case for the opinion of the High Court. It was contended, on behalf of the appellants, that the severance of the connection, assuming it to have been lawful, really put respondent in the position of taking a new supply, and that they were entitled to say that it must be to each house separately. For the respondent it was submitted that the cutting-off was unlawful because the owner, and not the tenant, was liable for the water-rate, and in such a case the Company could not stop the supply for non-payment. After an adjournment for several days, the respondent's Counsel asked that the case might go back to the Justices; and the Lord Chief Justice said it would do so for a finding of fact as to whether or not the cutting-off was lawful. The Justices again considered the case, and came to the conclusion that a verbal agreement had been entered into between the plaintiff and a representative of the Company for a supply of water to the houses, and that in consequence of this agreement, which made him liable for the rate, it was unlawful for the Company to stop the supply. Moreover, they had ample security in the owner.

The Colne Valley Water Company were the plaintiffs in an action against the Watford Gas Company for permitting water from a leaky gasholder tank to percolate into their works. After two hearings, however, the parties came to an amicable settlement. The terms included a large expenditure on the part of the Gas Company to obviate any possible danger arising in the future from the cause mentioned; the Water Company contributing a small amount towards the cost of new works to be put in hand at once. The Gas Company were also defendants in an action brought against them by the Thames Conservancy for three offences in connection with the pollution of the River Colne by water from the same tank. The Company pleaded guilty to one offence, but urged extenuating circumstances; it being stated on their behalf that before they could reach the leaky place in the gasholder they had to pump away 450,000 gallons of water. The Engineer acted to the best of his ability in exceptionally difficult circumstances. The Conservancy consented to the withdrawal of the other summonses. There had been a serious destruction of fish; and the Magistrates imposed a penalty of £20, with £30 to cover costs.

The question of shareholders' rights to back-dividends came before Mr. Justice Parker, in the Chancery Division, on a special case stated to obtain the opinion of the Court as to the respective rights of three classes of ordinary shareholders in the South Essex Water Company in respect of the profits which in any year were available for distribution after the dividend for each year on all the ordinary stock, at the rate prescribed by the Water-Works Clauses Act, 1847, and the Company's Special Act, had been paid in full. The Court was asked to say how the undivided balance in hand should be apportioned. His Lordship held that the case was on all-fours with the Weymouth case, which was reported in the "JOURNAL" for Feb. 21, 1911 (p. 536), and noticed in last year's "Review," where the Court held that, in making up the deficiency, the Company were bound to preserve, between the total amounts paid by way of back-dividends to the holders of the different classes of capital, the proportions prescribed by section 75 of the 1847 Act and the Company's Special Act as the maximum dividend on the different classes of shares respectively until the arrears to date were all paid. He accordingly made an order to this effect, and directed that the Company should pay the costs of all parties.

In the King's Bench Division, towards the close of last month, Mr. Justice Bailhache gave judgment in an action brought by Messrs. Stanley Bros., Limited, colliery owners and brick and tile manufacturers, against the Nuneaton Corporation, to determine the price at which they could claim a supply of water. The claimants contended that the price should be 2d. per 1000 gallons; the Corporation, on the other hand, said it should be 8d. The question turned upon the construction of a covenant in a conveyance; and the Court had also to consider two points of law submitted by an Arbitrator, to whom the matter had been referred, and who had, in substance, found in favour of the Corporation. He had stated his award in the form of a special case, with several alternatives; and the question for the Court was whether or not the award was right, and, if not, which of the alternatives should be adopted. It appeared that the claimants had for some years been paying the higher figure for their water; but they said they had done so in ignorance of their rights under the convenant. The matter was somewhat complicated; but, in the result, his Lordship decided that Messrs. Stanley were entitled to require the respondents to supply them with water at a price not to exceed 2d. per 1000 gallons. The claimants asked for the return of money they had overpaid—viz., £2314. This the Arbitrator had reduced to £1718 by disallowing certain items; and his Lordship upheld him in so doing. He reduced the amount still further by reason of the Statute of Limitations, and made it £1426. Stay of execution was granted in view of an appeal.

The old question of the liability of the Liverpool Corporation to be rated as beneficial occupiers of the gathering-ground in connection with their Rivington Water-Works occupied the Judicial Committee of the House of Lords, consisting of the Lord Chancellor, the Earl of Halsbury, and Lords Atkinson and Shaw, for two days towards the close of last month. The matter came in the first instance before the Justices at the Preston Quarter Sessions on an action by the Chorley Union and the Overseers of Withnell. A considered judgment was delivered by the Chairman (Mr. H. Worsley-Taylor, K.C.) in favour of the Corporation; but he stated a case for the opinion of the Higher Court. Both that Court and the Court of Appeal, however, decided that the Corporation were liable. All these proceedings have been duly recorded in the "JOURNAL." The Corporation then took their case to the highest tribunal, where it was in the able hands of Mr. Balfour Browne, K.C., who submitted that an owner could be in possession of land and occupy it so that he could maintain an action for trespass, and yet not have such beneficial occupation as to entail rating. His contention was that the Corporation did not beneficially occupy the land in question. They had possession, but it was not coupled with beneficial user; and therefore they were not liable to be rated. Mr. Macmorran, K.C., who followed on the same side, contended that the possession which the Corporation had of the property did not render them liable to be rated, because they did not occupy, or intend to occupy, it in any way that would bring them a profit. At the close of the learned Counsel's argument, the Lord Chancellor said that their Lordships did not desire to hear Counsel for the respondents (Mr. Danckwerts, K.C., leading), and would consider their decision.

ARBITRATIONS.

Arbitration questions being in the nature of legal proceedings, those which have arisen during the year may be conveniently noticed here. On the 28th of February, the hearing commenced of an arbitration to determine the price to be paid by the Slough Urban District Council for the undertaking of the Slough Water-Works Company. The proceedings arose out of an Act passed last year to carry into effect an agreement made between the parties. The Company asked £111,477 for their undertaking; and the Council offered them £89,000. The Umpire (Mr. A. J. Ram, K.C.) awarded £90,623, which included the Company's perpetual debentures. The Council took over the works at the end of September. Towards the close of May, an inquiry was opened, and lasted for several days, to determine the amount to be paid to the Oystermouth Water Company by the Urban District Council for their undertaking, for which

they asked £15,000. The Arbitrator, Mr. S. R. Lowcock, M.Inst.C.E., who was appointed by the Local Government Board, awarded the Company £7740. Early in October, arbitration proceedings were opened as the result of a resolution passed by the Derwent Valley Water Board to the effect that the works in their entirety, including the whole length of the aqueduct as constructed, were to be regarded as one joint undertaking, and that the expenditure thereon was to be provided by the four constituent Corporations (that is Sheffield, Leicester, Nottingham, and Derby) in their statutory proportions. This was objected to by Sheffield, which contended that it had no interest in a defined portion of the works, and therefore declined to contribute to their cost. The Board made out that Sheffield was liable for £807,312; whereas Sheffield said the figure should be £511,664, or £295,648 less. The proceedings took place under a provision of the Board's Act of 1899 for the appointment of a standing Arbitrator—Mr. C. A. Russell, K.C.—and he made an elaborate award, the details of which were given in the "JOURNAL" for the 12th ult. (p. 534). He practically accepted the figures submitted by Sheffield, and instead of adding the difference just named, he put on less than £50,000. Arbitration proceedings, under the Lands Clauses Act, have quite recently been held in London to determine the price to be paid by the Church Stretton Urban District Council for the undertaking of the Church Stretton Water-Works Company, Limited, under the authority contained in the Act of the present year already noticed. The purchase price put by the Company was £27,211. The Arbitrator (Mr. A. J. Ram, K.C.) had not made his award when this number of the "JOURNAL" went to press.

TECHNICAL BUSINESS.

Coming to the technical matters connected with water supply which have engaged attention during the year, the two meetings of the Institution of Water Engineers first call for some notice. At the summer meeting, which was held at Cheltenham early in June, under the presidency of Mr. J. S. Pickering, M.Inst.C.E., the Borough Engineer and Surveyor, the members received a very cordial welcome from the Mayor, Mr. C. H. Margrett. The Inaugural Address of the President embraced a variety of interesting subjects, including modern reservoirs, the sources and quality of water, pumping plant, &c. Additions were made to the roll of members, bringing the total to 396, as compared with 387 for the year 1910-11; and a number of papers were submitted and discussed. The Secretary, Mr. Percy Griffith, described the new water-works at Skegness; Mr. E. H. Crump, those at Hinckley; and Mr. R. Read, the reservoirs of the Gloucester Corporation at Witcombe. The pollution and purification of water were dealt with by Dr. J. H. Garrett and Mr. G. Embrey; and Mr. L. Richardson gave an account of the geology of Cheltenham, with special reference to water supply. The rating of water undertakings was the subject of two papers—one by Mr. Donald Dinwiddy, and the other by Mr. Arthur Valon, whose work on this somewhat troublesome question is known to many readers of the "JOURNAL." In addition to the papers, an important report on the work of the Incorporated Joint Committee on Water Regulations, prepared by Mr. F. J. Bancroft, M.Inst.C.E., was read by the President; visits were paid to the Tewkesbury pumping-station and the Dowdeswell and Hewletts reservoirs of the Cheltenham Corporation, and also to the reservoirs at Witcombe.

Towards the end of September, a party of members of the Institution paid a visit to Cardiff, and inspected the Llwyn-On reservoir works of the Corporation, which are being carried out to the designs and under the supervision of Mr. C. H. Priestley, M.Inst.C.E., one of the Past-Presidents. The works are in the Cwm Taff Valley, 30 miles or so from the city.

At the winter meeting, which was held on the 14th inst., under Mr. Pickering's presidency, the numerical strength of the Institution was increased. There were three papers on the *agenda*, but only two were read and discussed—one by Dr. Adolph Kemna, of Antwerp, on "Recent Advances in the Science of Water Purification;" and the other by Dr. J. C. Thresh, on "Some Recent Examples of Pollution of Public Water Supplies." The principal portions of these, with some notes of the discussions upon them, were given in the "JOURNAL" last week. The remaining paper was by Mr. Edward J. Silcock, M.Inst.C.E., on "The Valuation of Water Undertakings on Transfer to Local Authorities." Owing to the long time occupied in discussion of the two papers first named, it was thought advisable, in view of the importance of the subject dealt with by Mr. Silcock, to postpone both his paper and the discussion upon it till the next meeting. This will take place during next summer; and the members have been cordially invited by the Mayor of Wakefield to hold it in that town, which is the home of the new President, Mr. C. Clemesha Smith, M.Inst.C.E., the Water Engineer to the Corporation.

A few interesting papers upon water supply were submitted to the members of the German Gas and Water Association at their annual meeting in Munich towards the end of June. Herr H. Peter, of Zurich, described some new methods of sterilizing large quantities of water, and dealt with their technical and economical applicability. Dr. Bruns, a professor at Gelsenkirchen, reported upon certain experiments made for the disinfection of drinking water in the distribution system by the addition of chloride of lime. Herr Reese, of Dortmund, presented the results of an investigation that he had made, at the desire of the Association, into the effect of the drought of 1911 upon the water supply of towns. In order to collect the needful information, he addressed a letter of inquiry to the officials of 421 water-works included in the volume of statistics published by the Association, and received answers from 327 of them; and of these 235 reported that they had not suffered from scarcity of water, though 37 were working near the limit of their capacity, and had adopted measures for the extension of the plant. The only other communication relating to water supply was by Herr Hocheder, one of the chief Government officials of Munich, who dealt with the subject of the water supply of towns and districts in Bavaria. He referred to the difficulty experienced in obtaining any adequate supplies of water in certain places, notably in the Franconian Jura Mountain districts, and to the measures the State was adopting to assist these localities to improve the supplies.

At the last annual convention of the American Water-Works Association, Mr. Edward Wegmann read an interesting paper on "Ancient and Modern Water-Works." He first described the water-works of ancient Rome, and then those of New York. The portions of the paper bearing specially on these subjects were given in the "JOURNAL" last week.

Returning to our own country, it may be noted that the water-works at Bridlington were described by Mr. Sidney Charlesworth, the Deputy-Chairman of the Water Committee of the Corporation, in a paper he submitted to the members of the Institution of Municipal and County Engineers, on the occasion of their meeting in that town; and those at Osaka, in an article in a number of the "Financial News" specially devoted to Japan. An interesting paper on the development of the Cardiff Water-Works was read to the members of the Royal Sanitary Institute by Mr. C. H. Priestley, M.Inst.C.E., the Water Engineer to the Corporation, on the occasion of a provincial meeting in the town in the spring. Dr. John F. Meyer described, at a meeting of the Institution of Municipal Engineers, the properties of "Permutit" for softening and purifying water, about which Dr. Thresh spoke very highly at the recent meeting of the Institution of Water Engineers. At a meeting of the Institution of Municipal and County Engineers held at Stourbridge, Mr. W. Fiddian, the Consulting Engineer to the Stourbridge and District Water Board, read a paper in which he described the boring operations which have been carried out in connection with the undertaking. At the congress of the Royal Sanitary Institute at York, Mr. T. Salkield, the City Engineer of Delhi, gave some particulars of the water supply of that city, and they aroused special interest in view of the fact that it has been chosen as the seat of Government of India.

Reference has already been made to the research work of Dr. A. C. Houston, the Director of Water Examination of the Metropolitan Water Board. In a valuable report presented in the spring, he described in great detail the "excess lime" method of treating water—primarily for the destruction of bacteria, and secondarily and incidentally for softening purposes. The other literature connected with water supply noticed in our columns during the year has included a pamphlet issued by the Incorporated Joint Committee on Water Regulations, containing information of much value to water engineers; an epitome of a report presented to the Massachusetts State Board of Health by Messrs. H. W. Clark and Stephen De M. Gage, upon the subject of the corrosion of metal pipes by water; and some

particulars from a long report by Sir Alexander Binnie, in collaboration with Sir William Ramsay and Dr. Otto Hehner, on the corrosion of the steel conduit, 350 miles long, laid at a cost of £2,500,000, to provide the district of the Coolgardie gold mines with water. An investigation was made into the causes of both the external and internal corrosion of this long pipe-line and the means of remedying them; and the report indicates the measures recommended, and furnishes an estimate of the cost of applying them. The subject was of considerable interest to all responsible for the distribution of water.

This reference to responsibility will serve as an introduction to a notice of the formation of the Municipal Water-Works Association, composed only of members of municipal bodies supplying water to places having more than 50,000 inhabitants and of their chief officers. The first annual general meeting was held at the offices of the Metropolitan Water Board on the 26th of October, when Mr. E. B. Barnard, the Chairman of the Board, was elected President, and delivered an Inaugural Address, in which he indicated the nature of the work of the Association and the questions which would be dealt with in due season. At the close of the address, the Executive (Provisional) Committee presented their report, in the course of which they stated that the chief objects aimed at by the Association were to bring together representatives of municipal water authorities for the purpose of considering and discussing important questions which were constantly arising affecting their interests, and to "facilitate the acquisition of experimental, statistical, and scientific knowledge relating to the construction, control, and management of municipal water-works undertakings." The report was adopted. Office-bearers and an Executive Committee were appointed; the Hon. Secretaries being Mr. C. G. Henzell, the Water Engineer to the Leeds Corporation, and Mr. William Terrey, the General Manager of the Sheffield Corporation water undertaking. The Vice-President is Bailie Archibald Campbell, the Convener of the Water Committee of the Glasgow Corporation; and, on his proposition, it was decided to hold the next annual meeting in that city. In connection with this new departure, it may be mentioned that in the spring news reached us from America of a proposal to form an Association consisting of the chief engineers and superintendents of the Water Departments of municipalities for mutual benefit through closer contact and greater co-operation among them. The proposal was very cordially received.

Personal Matters and Deaths.

Before closing this retrospect, a few personal matters which have occurred during the year call for brief notice. In the list of New Year honours conferred by His Majesty the King were knighthoods for Professor W. F. Barrett, F.R.S., of Dublin, and Dr. R. J. Collie. The name of the former has appeared from time to time in the "Journal" in connection with his investigations into the subject of divining for water; the latter is the Chief Medical Officer of the Metropolitan Water Board. The Corporation of Nottingham decided to confer the honorary freedom of the borough upon Sir Edward Fraser, on his resignation of the chairmanship of the Derwent Valley Water Board; and the Corporation of Leicester came to a like decision in regard to his successor, Sir William Vincent, who has twice held the office of Mayor. The honorary freedom of Blackpool was conferred upon Alderman J. Bickerstaffe, the Chairman of the Fylde and District Water Board. The medal of the Society of Chemical Industry for conspicuous service was presented to Sir William Crookes, O.M., F.R.S., who for many years was one of the chemists who reported, for the Companies, on the water supply of the Metropolis.

Among the official changes of the year, the following have to be recorded: Mr. J. W. Armitage was appointed Water-Works Manager at Huddersfield, in succession to Mr. J. W. Schofield; Mr. Joseph Bradley, Superintendent of the Water Department of the Bolton Corporation, in succession to Mr. W. Hutchinson, who had retired; and Mr. F. W. Davies, the General Manager of the Nottingham Corporation water undertaking. Mr. C. Durrant, Manager of the Isle of Wight Water-Works; Mr. J. C. Hawkins, the Engineer of the Paignton Water Company, obtained the position of Engineer under the Irrigation Department of the South African Government. Alderman Edward Holt, J.P., was selected for the chairmanship of the Manchester Corporation Water Committee, in succession to the late Sir Bosdin T. Leech. Mr. T. Loftus relinquished the position of Clerk and Solicitor to the Fylde Water-Works Board, and Mr. E. Whiteside was chosen as his successor. Mr. T. Oswald Pepper, Assoc.M.Inst.C.E., was appointed local Manager and Engineer of the Andalusia Water Company. Mr. Smith Whitehead, the Assistant to the Borough Engineer of Nelson, was raised to the position of Water Engineer. Mr. C. N. Wood was appointed Secretary and Manager of the Barnstaple Water Company.

It is gratifying to be able to record several cases of recognition of services, either by increases of salary or by presentations. Conspicuous among them was an honorarium of £500 to Mr. J. Cook, the Engineer to the Fylde Water Board, in respect of services rendered in connection with the Higher Hodder scheme and the passing of the Board's Bill. For similar reasons, Mr. C. Arthur, the Secretary, had £100 voted to him, in addition to an increase of salary. Mr. Basil Mackenzie, who relinquished the position of Works Manager of the Kinder water scheme of the Stockport Corporation on the completion of the undertaking, was presented, along with his wife, with a flattering public testimonial, as a mark of the esteem in which they were held. Mr. J. S. Pickering, the Borough and Water Engineer of the Cheltenham Corporation, and President of the Institution of Water Engineers, was presented by the Town Council with an honorarium of £300, in respect of special works carried out by him. Mr. Frederick Storr, the Engineer and Secretary, and Mr. Robert Roberts, the Accountant, of the Wrexham and East Denbighshire Water Company, received from the Directors valuable presents in recognition of their forty years' service with the Company.

During the year, we have unfortunately had to record the removal by death of several gentlemen closely connected with water-works undertakings. They were: Mr. W. Anderson, Treasurer of the Edinburgh and District Water Trust; Alderman Charles Gabriel Beale, Chairman of the South Staffordshire Water-Works Company; Mr. W. Blackstock, Secretary to the Manchester Corporation Water Committee; Mr. S. Buckley, a prominent member of the Water Committee of the Oldham Corporation; Mr. J. Easton Cornish, Chairman of the Alexandria Water Company; Mr. W. D. Cruddas, Chairman of the Newcastle and Gateshead Water Company; Mr. J. Durrant, Manager of the Isle of Wight Water-Works; Mr. Gabriel Dyson, formerly the Water Engineer to the Colne Corporation; Mr. J. G. Frost, the Chairman of the Hawarden Water Company; Mr. W. Grant, Chairman of the Portsmouth Water Company and of the Portsmouth Water-Fittings Company; Mr. James Hartley, Water Engineer to the Corporation of Nelson; Herr A. Herzberg, a prominent water engineer of Berlin; Mr. W. Hutchinson, formerly Indoor Superintendent of Water-Works to the Bolton Corporation; Sir Bosdin T. Leech, Chairman of the Manchester Corporation Water Committee; Dr. William Ogle, a member of the Royal Commission on the Metropolis Water Supply in 1892-3; Mr. Edwin C. Pole, Manager of the Neath Water-Works; Mr. W. H. Rothwell, formerly Secretary to the Ashton, Stalybridge, Dukinfield, and District Joint Water Board; Mr. J. W. Schofield, Manager of the Huddersfield Water-Works; Mr. T. Schofield, formerly Manager of the Mexborough Water Company; Mr. A. B. Shaw, Junior Counsel in the parliamentary and legal proceedings of the Metropolitan Water Board; Mr. G. O'Sullivan, the City and Water-Works Engineer of Dublin; Mr. M. A. Troughton, Chairman and Treasurer of the Gravesend, Milton, and Northfleet Water Company; Mr. Harry Wilkins, formerly Secretary of the Lambeth Water-Works Company; Mr. Abraham Woodiwiss, one of the representatives of Derby on the Derwent Valley Water Board; and Mr. G. E. Woodford, for forty-two years Secretary of the Ruabon Water Company.

The "Notification" of the Metropolitan Gas Referees for the ensuing year was issued last Tuesday. There is no indication of the introduction of any alteration since the publication of the previous "Notification."

The Council of the Society of Engineers may award during the year 1913 a premium of books or instruments to the value of £10 10s., for an approved essay on "A Scheme for the Registration of Engineers, including particulars concerning the Registration of Engineers in British Colonies and Foreign Countries." The Council reserve the right to withhold the premium if the essays received are not of a sufficient standard of merit. The competition is open to all; but, before entering, application for detailed particulars should be made to the Secretary (Mr. A. S. E. Ackermann), No. 17, Victoria Street, Westminster. The last date for receiving essays is the 31st of May.

ALLOWED STRAINS IN GASHOLDER DESIGN.

By Engineer.

Under the above title, an article in the "Journal" for the 17th inst., p. 909, sets out the recommendations of a Committee of the American Gas Institute appointed to report on the Standardization of Gasholder Design. To many gas engineers such an attempt may be seem difficult and ill-advised; and they may think that each case should be treated strictly on its merits. Yet there are many of the salient features, all dealt with in the report, that should be standardized in this country; and any such attempt, however informal, would be of benefit to the industry. It would certainly diminish the habit of some contractors to cut things down to their finest possible margin, which tendency is bound to exist, when tendering for a holder in the absence of drawings, specifications, or quantities supplied by the inquirer.

The writer thinks, therefore, that the following figures, dealing with matters considered in the report, will help an engineer who is perhaps sending out only his first or second inquiry for gasholder work, to embody certain requirements in his work, and thus assist him in getting tenders more comparable than at present. They will also help him in choosing the most favourable offer when the tenders are received, and may restrain him from accepting the lowest price when the article offered is not so good as others. On the other hand, by knowing where to look for the salient points, he may be led to accept the lowest price, being able to rely on his judgment in the light of knowledge.

In submitting these notes and figures, the writer is not attempting to set any hard-and-fast rules, or to define a "standard" practice as it exists, for none does exist. He is merely, from an experienced engineer's (not contractor's) standpoint, endeavouring to guide others who may require assistance, and to place before them figures which, in his opinion, will make good, substantial work, proof against extreme variation in conditions, and which will be built to last, assuming proper attention is given to the structure when it leaves the contractor's hands.

The letters and figures attached to the following clauses conform to those that appeared in the original report referred to.

(*A*) Maximum Allowable Unit Stresses.

1.—Tank steel	5½	tons per sq. in. working stress.
2.—Structural steel	6	tons per sq. in. working stress.
3.—Rivets—Single shear . .	5	tons per sq. in. working stress.
Double shear .	9	tons per sq. in. working stress.
Bearing strength.	8½	tons per sq. in. working stress.

(*B*) Uniform Assumptions of Loads.

1.—Wind Load: For ordinary cases, 16 to 20 lbs. per square foot, corresponding to a velocity of 55 to 60 miles per hour. For extremely exposed positions, increase this as required to 24 lbs. per square foot (70 miles per hour). This pressure to be considered distributed over the cross section (*i.e.*, the diameter multiplied by the total height).

2.—The snow load shall be 4 to 5 lbs. per square foot (corresponding to snow 9 to 12 inches in thickness, according to the district) over 33 per cent. of the crown, and considered as a concentrated load applied 60 per cent. of the radius, measuring from the centre to the leeward side. [Note.—This combination of snow on a portion of the leeward side, acting in concert with the wind, is the worst possible.]

3.—The static water head should be taken in all cases, except the bottom row, from the lower line of rivets in the plate in question, as this is the point where the maximum stress occurs. If we have plates 6 feet broad, then, using the "centre of plate" rule, we should actually have a static head of 3 feet more at the bottom of the plate than that designed for. For the bottom tank plate, which is joined to the bottom curb, the static head may be taken as 9 inches from the rivet course, as this amount may be considered as the assistance given by the curb.

4.—Crown Curb: The necessary material in this to withstand the compression varies with the nature of the curb design. The inquiry here rather ties one down to the type of design. Often 2, 3, or 4 feet in each direction mentioned are utilized by having double radial gussets from the vertical stiffeners, or a continuous gusset making the whole curb into a triangular box. If the first system is adopted, a second angle in the crown, running parallel to the main angle curb, is used.

5.—It is difficult, again, to put a definite figure for the pressure of the top or inner lift. The pressure thrown depends mainly on the proportion of height to diameter, thickness of sheets, and whether the crown carries its own framing or not. Available space often limits one to a maximum diameter. The writer thinks that this query would be met by asking the contractor to state on his drawing the pressure thrown by each lift; or, if capable of drawing up his own design and specification, then he would be capable of working out these pressures for himself, and for the gas at the specific gravity at which he sends it into the holder.

6.—It is certainly advisable to take account of the efficiencies of the joints in steel tank design; for on these efficiencies depends the thickness of the plates used in all the lower tiers. Up to 750,000 cubic feet, single and double riveted lap joints are sufficient. The former for the thin top tiers, having an efficiency of 65 to 70 per cent.; the latter having an efficiency of about 74 to 78 per cent. For large holders, double and treble riveted butt-joints become necessary, with efficiencies up to 90 per cent.; and by a careful arrangement of these joints, the saving in plate thickness can be considerable. It must be remembered, of course, that one is usually limited by the fact that the joint must be made water-tight; hence the low efficiency in single-riveted lap joints. But the low efficiency in the top plates is not a matter for regret, since the erection cost of such joints is low, and the thicknesses required are influenced by practical considerations.

(*C*) Kind and Grades of Materials.

1, 2, and 3.—The figures herein mentioned are all satisfactory; but it is well for engineers to specify all steel to be the British standard specification, and made by the Siemens-Martin process. This would have an ultimate tensile strength of 28 to 32 tons per square inch, with an elongation of not less than 25 per cent. on an 8-inch specimen, and a contraction of area of not less than 40 per cent. at the point of fracture. The bending test should be similar to that given. It is to be noted that in the American inquiry the percentage elongation is not combined with any particular length, which provision is necessary. It is well, also, to limit the percentage of phosphorous to 0·06 per cent., the figure mentioned, owing to the tendency of this element to make the metal brittle. The sulphur should be only a little less than the phosphorous, as these elements tend to neutralize the effect of one another.

4.—Gasholder Sheets: Here, again, Siemens-Martin steel should be specified, if steel is to be used. Manufacturers will not agree to any specified tensile test, but the bending test should be severe—say, 180°, almost flat, leaving a space at the bent portion equal to the thickness of the sheet. Under this test the outside should be be free from fracture. Specify all thicknesses up to No. 8 gauge in imperial standard wire gauge; and to make assurance doubly sure, add the weight per super foot, which can be found in most pocket-books. Above this gauge, the thickness may be given in fractions of an inch. The writer has, however, come in contact recently with some cases of undue pitting and holing of steel plates in exposed positions subject to sea breezes, near water-gas plants, acid plants, and in hot countries. Many engineers are considering the advisability of returning to wrought iron for this part of the work, as it is undoubtedly more lasting. It costs roughly £1 a ton more, or (say) £120 more on a 1,000,000 cubic feet holder, and at the present time is exceedingly difficult to get. But when the demand increases, the makers will commence rolling in greater quantities. It also behoves managers with steel holders to keep them well painted, with the best paint for the purpose.

5.—Rivets: The tests here mentioned are very good generally. Specify a 25 per cent. extension on a 10-inch specimen, and a 50 per cent. contraction of area at the point of fracture. If one wishes to add a further test, insert: "The head must be capable of being flattened down while red hot, until its diameter equals 2½ times that of the shank, without showing signs of fracture."

(*D*-1) Minimum Thicknesses, &c., of Material as Determined by Practical Considerations.

1.—Tank Bottom: Use 3-16th inch plates only in the smallest of gasholders—say, up to 25 feet in diameter and 10 feet deep (5000 cubic feet); ¼-inch plates up to 65 feet diameter and 17 feet deep (say, 150,000 cubic feet); 5-16ths inch plates up to 110 feet diameter and 26 feet deep (say, 750,000 cubic feet); and ⅜-inch plates beyond this. In all cases except the first-mentioned, it is advisable to have an outside row 1-16th inch thicker for smaller sizes and ⅛ inch thicker for larger sizes, to fix to the bottom angle curb.

2.—Tank Side Plates: Never use 3-16th inch plates anywhere. The top row of side plates, although subject to little water pressure, is joined to the top angle curb, in addition to which it has a portion of its surface at or near the water-line, and is therefore subject to corrosion to a rapid degree. Never use less than ¼ inch, and in holders of more than 750,000 cubic feet capacity use 5-16th inch for the top tank-sheets.

3.—Crown Sheets: In holders up to 5000 cubic feet, 13 or 14 gauge sheets could be used; but the writer never specifies less than 12, which size can do duty for holders up to 150,000 cubic feet. In larger holders, No. 10 gauge sheets, or even No. 8 gauge in exposed positions, previously mentioned.

4.—Side Sheets: Generally follow the same rules as for the crown. [Note.—The above gauges do not apply to crown sheets adjoining the top curb or side sheets adjoining the cups or grips.] For holders up to 750,000 cubic feet, use 3-16th inch sheets for all rows above mentioned, and also for the sides of cups and grips. Above this size, use ¼ inch; and for holders of more than 3 million cubic feet, 5-16th inch. The row of outer crown sheets should be made wide enough to take the base plates of the top carriages. The size of cups and grips depends on the "seals" required; and the cup and grip sheets need not be made more than 8 or 10 inches broader than the amount of the "seal."

5.—Extension of Standards: Always carry the standards down into the concrete foundation of the tank. This may seem to our American friends to be going to extreme lengths; but let us design our tanks for static water pressure alone, making it quite independent of the stresses in the guide-framing. Curb it and stiffen it, and let all this extra stiffness be provision against the unforeseen. Incidentally, the writer usually adds an intermediate tank curb gusseted to the standards, in tanks more than 20 to 22 feet deep (say, for holders of more than 400,000 cubic feet).

6.—Wind-Ties: Many engineers build large holders without

them; but the writer prefers chordal wind-ties in all holders above 130 feet diameter, 1¼ million cubic feet.

7.—Crown Framing: Here it seems really difficult to make any attempt at standardization. Different constructions can be adopted for steel tanks, masonry tanks with low or high dumplings, or annular tanks. A plain centre pier would only be suitable for holders up to 16 or 18 feet diameter. The wooden spider frame or "umbrella" is giving place to the iron or steel one; but for holders up to 80 feet diameter a metal framing in the crown itself, fixed to the curb and having a centre post, is the best system. Above this size, a framing in the tank is best—of timber, steel, or often a combination of both.

8.—It is very necessary to have guard-rails round the crown, as well as a platform and rail round the tank, when the latter is above ground. The diameter of the rail depends on the pitch of the standards. Say, ¾ inch, if the standards are 5 feet apart, and 1 inch if they are 7 or 8 feet apart. A similar rail round the grip-channels of the holders of any size would be useful, though not often met with in this country. Provide also an efficient ladder, with landing-stage at the crown.

9.—The extension of the grip-plate 4 or 6 inches beyond the channel is excellent for retaining the water in cases of high wind, and in exposed positions may be put in with advantage. The grip channel should always be the same size as the cup channel; and the channel construction is the best form for these portions.

(*D*-2) General Construction.

1.—Tank sheets may be riveted metal to metal. Gasholder sheets should have a strip of tape the width of the lap soaked in red lead and boiled linseed oil.

2.—Landing blocks should not be fixed to the tank bottom, but should have broad chairs, and if of timber they should be well weighted.

3.—When the container is landed, in order to get the maximum effective storage out of the material, and to allow room for constructing the rollers and carriages of varying sizes, the following will be a useful guide: When landed, the top of the outer lift grip channel should be 3 inches below the top of the tank curb (*i.e.*, about overflow level). The lifts in turn going towards the centre should then be each 3 inches higher than the preceding one.

4.—All plates, sheets, curbs, channels, and beadings should be riveted. Bolts may be used with advantage in fixing the vertical guides and stiffeners to the sheeting; also in the guide-framing, such as fixing cross girders to main girders, and the tie rods to main girders. In fixing carriages to the base and in portions of the guide-framing, bolts are really a necessity, for slotted holes are often used to allow for adjustment, thus saving considerable drilling on the site in positions difficult of access.

5.—This is a good feature, provided the roller can be adjusted by some independent method.

5*a*.—Intermediate legs or guides are only necessary when the holder columns are pitched very far apart, in which case the suggested method of fixing provides an advantage, though not, in the writer's opinion, a necessity.

6.—This is according to the usual method in this country.

7.—Ditto, except that sometimes both plates and rolled sections are used.

8.—Very necessary.

9.—Very necessary.

10.—Ditto, and never specify one pipe only. Specify also inlet, outlet, and bye-pass valves. The latter, though not a necessity, is useful.

11.—Should be embodied somewhere in the specification.

12.—Ditto. Specify also that the pipe is to fall from the bend leaving the underside of the tank, back to the drip-pots or syphons.

13.—This will also apply to steel tanks partly embedded.

(*E*.) Major Dimensions for Standard Size Holders.

1.—The writer's comments on this are covered by his remarks under (*B*., 5). It often happens that a company are not limited to diameter, but are limited to height by clauses in their Act of Parliament, ancient lights, &c.

2.—This is the correct method of working out the effective capacity of a holder. A rough rule is: The area of the middle lift, multiplied by the heights of lifts added together, less 3 or 4 feet (for a three-lift holder).

(*d*) Is a very necessary provision.

The writer considers that the broad classification into two sections—viz., up to 1,000,000 cubic feet and above that size—is not advisable. Thereis too much difference between holders of 10,000 cubic feet and those of 1,000,000 cubic feet to put them all under one group for the purposes of a standard specification.

Some Further Notes.

A few further notes may be of interest. Avoid joining very thin sheets to rolled sections; the result is bad joints. Channels for the tank and outer lifts perform the double duty of stiffeners and guides for the bottom rollers. A channel is also useful, fixed to the guide-framing, for the top rollers. All rivets and bolts for fixing these channels should be countersunk. The stiffeners for the top lift can be made of tees for lifts up to 24 feet deep, and steel joists for larger ones.

Carry the tank channel guides up 3 inches or so above the curb level. In designing riveted joints, remember that tank joints must be water-tight, but joints in guide-framing are designed for strength only. Get equal strength in tension, shear, and bearing. Any adjusting bolts should be independent of the crown or side sheets. All joint plates should have at least equal section to the member jointed, and should be from 1 ft. 6 in. to 2 ft. 6 in. long, according to circumstances. All rollers should have effective means of lubrication. The larger the rollers the better (within reason).

It is important to insist on all the metal being worked on before rust has attacked it. Have it coated with boiled oil at the contractor's works before rusting would appear, and put on a coat of paint immediately each section is erected.

The Committee's report also refers to a sub-section (*f*) "Duties of Contractor and Purchaser." We have, of course, the agreed general clauses between the Institution of Gas Engineers and the Society of British Gas Industries, which an inquirer might embody or refer to in his specification, with such amendments as he may wish to insert. Often one wishes to vary the clause referring to payments. This is, however, generally based on a certain percentage of materials delivered and work done up to 80 or 90 per cent. on completion of test.

A gasholder should be inflated with air by the contractor, and all seams tested with soap and water. It is as well to state a time for completion; but it is difficult to get payment of penalties unless the company can prove that they have been put to financial loss by the non-completion of the work. The standard clauses referred to limit the penalty to 10 per cent. of the total amount of the contract, or 25 per cent. if it does not exceed £500. The writer, however, would prefer to embody in the contract a clause similar in wording, but not limited to the figures mentioned, as this would possibly not cover the direct damage or loss resulting from the delay.

Some of the points have been touched on very shortly; but by comparing each numbered paragraph with the article referred to, it is hoped that the meaning will be clear to all, and that these notes will prove of some assistance to those who come only occasionally in contact with this fascinating part of our work.

GAS-WORKS PITCH INDUSTRIES AND CANCER.

In the "Journal" for Aug. 1, 1911 (p. 293), it was mentioned that the medical authorities of the Home Office had drafted some regulations to be applied to people engaged in the manufacture of patent fuel with the addition of pitch. Objections were raised to the regulations; and the Home Secretary directed an inquiry to be held by Mr. A. H. Lush, Barrister-at-Law, whose report was noticed in the "Journal" for Sept. 19, 1911 (p. 744). Towards the end of the inquiry, a proposal was made that, before the regulations were finally settled, time should be allowed for experiments to determine the various questions left undecided; and the period was understood to be twelve months, in the absence of reason to the contrary. It appears that the inquiry is shortly to be reopened; and, in view of this fact, attention may be called to a pamphlet just issued by Mr. John Murray, of Albemarle Street, W., bearing the title of "The Problem of the Gas-Works Pitch Industries and Cancer." It contains the results of important investigations carried out by Mr. H. C. Ross, M.R.C.S., &c., and Mr. J. W. Cropper, M.B., M.Sc., followed by some observations by Mr. W. J. Atkinson Butterfield, M.A., F.I.C. The conclusion arrived at by the two first-named gentlemen is that the dangerous principles are contained in the heavy oils of the coal tar; and these cannot be distilled-out completely without ruining the pitch. They recommend that distillation should be "carried to the utmost point compatible with producing a serviceable pitch." They say that washing the tar offers, so far as is at present known, "much the most satisfactory solution of the difficulty." Meanwhile, Mr. Butterfield and Mrs. Norris, B.Sc., of the John Howard M'Fadden Research Fund, out of which the expenses of the investigation are being defrayed, are making experiments with a view to the dangerous elements being isolated absolutely, and an analysis made of them. Included in the pamphlet is a reprint of an article by Dr. H. Bayon, Research Bacteriologist at Robben Island, Cape Colony, on "Epithelial Cell-Proliferation Induced by the Injection of Gas-Works Tar," which appeared in the "Lancet" for the 7th inst. The price of the pamphlet is 6d. net.

We have received from Mr. Walter G. Kent a tastefully printed book, of which he is the author, bearing the title of "An Appreciation of Two Great Workers in Hydraulics." The "workers" referred to are Giovanni Battista Venturi, born in 1746, and Clemens Herschel, born in 1842; and the book is dedicated to the latter. There are few readers of the "Journal" who have not heard of the Venturi meter; and it was in his capacity of Hydraulic Engineer of the Holyoke (Mass.) Water Power Company that Mr. Hirschel carried out the experiments which led him to embody the Venturi principle in the meter he constructed, for which he was accorded the Elliott-Cresson Gold Medal of the Franklin Institute. Mr. Kent, who is a member of the firm whose names are associated with the Venturi meter in this country, says that the purpose of his "Appreciation" will be served if those who hear the name of the former will be reminded of that of the latter, and accord to both men (whose portraits are given) the honour that is their due.

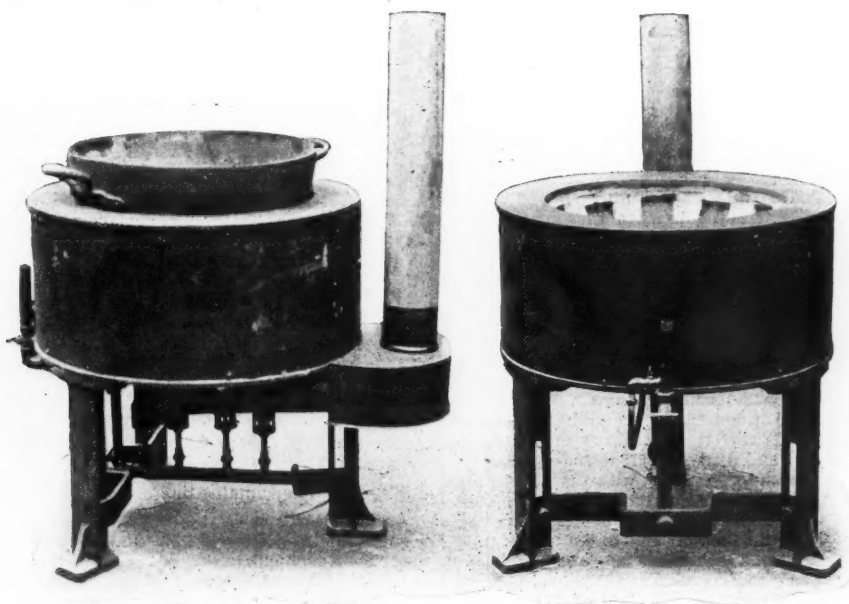
SUGAR BOILING BY GAS.

It was stated in last week's "Journal," in the course of a short article on the use of high-pressure gas in Maidstone (which was prepared from particulars supplied by Mr. Frank Livesey, the Engineer and General Manager of the Maidstone Gas Company), that gas is to be extensively used for sugar boiling in the town. Nine boilers, designed and patented by Mr. L. F. Tooth, of the Commercial Gas Company, will be used for this purpose in the factory of Messrs. Sharp and Co., manufacturing confectioners—this type of boiler having been found by experiment to be more economical than any other that was tested.

Mr. Tooth's boiler is the outcome of three years' experimenting; and it has been designed to meet the special requirements in connection with sugar boiling for the confectionery trade. Its production is, in fact, really due to co-operation with confectionery manufacturers, who indicated their various needs, so that the boiler could be adapted to these conditions. The highest efficiency of the boiler is, of course, secured with the use of high-pressure gas; but it can be worked also at low pressure, if desired. At Maidstone, as stated last week, the gas will be supplied at a pressure of 54 inches; and in this way, it is found that 40 lbs. of material can be boiled in thirty minutes, with a consumption of from 75 to 85 cubic feet of gas.

It will be understood, however, that the time of boiling depends upon the class of sugar to be dealt with. The qualities of sugar vary; and, in consequence, the time of boiling and the method of firing in the process also vary. For instance, one particular kind of sugar may require to be slowly boiled until just upon the point of completion, when an additional amount of heat would be required to finally cook the sugar. On the other hand, a different grade of sugar would call for exactly the reverse action. If the mixture was to be one of sugar and glucose, the sugar, with water, would be allowed to come to the boil, and when this stage was reached the glucose would be added, which would, of course, reduce the temperature, and the cooking of the sugar would then commence. Then, again, according to the quality of the sugar, the temperature at which it would be considered to be cooked would vary. There are also variations in temperature according to the climate in which the sugar is destined for consumption. The temperature deemed necessary for sugar boiled for use in the English climate would be from 310° to 320° Fahr.; whereas if the sugar was needed for export, it might be desired to bring the temperature up to 350° Fahr., in order that the finished article should not only arrive at its destination in a good condition, but remain so subsequently. Furthermore, the method of boiling, as already remarked, has to be varied according to the grade of sugar used. The process might be to quickly boil at the commencement of the operation, or to slowly boil at the beginning, and then to finish up at a quicker rate.

The construction of the Tooth sugar boiler will be largely gathered from the accompanying photographs; but it may be added that it consists of a top and bottom annular cast-iron ring, surrounded by a sheet-iron casing, which is attached to flanges on the cast-iron rings. The casing surrounds the fire-clay linings; a packing of non-conducting material being arranged between the sheet-iron sides and the fire clay. The burners consist of two rings, each fed by two bunsen tubes. The bunsen tube which is seen in the illustration, is in a vertical position; but it returns and enters the ring of the burner on the horizontal. Consequently, the feed from each bunsen tube circles round one-half



Tooth's Patent Sugar Boiler.

of the ring of the burner. The burners are fitted upon one float, which is raised and lowered by means of slots in the legs; the object of this raising and lowering being to meet the requirements of the quality of the particular gas being used, so that the necessary amount of secondary air for combustion may be admitted to the furnace. The flame impinges upon the base of the pot; and the products afterwards pass through a series of flues at the top edge, downward into the annular fire-brick chamber, and out of the two flues at the base of the furnace. These latter two flues, as will be noticed on looking at the left-hand photograph, are led into a box provided at the side of the furnace, having a direct flue outlet.

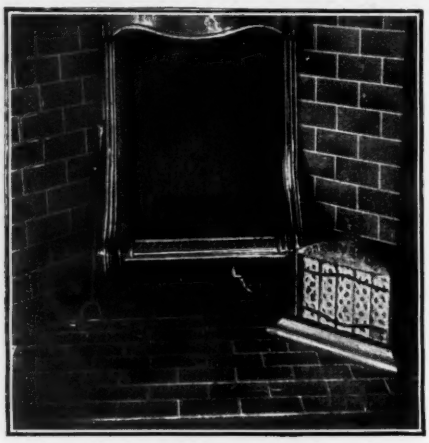
Mr. Tooth has forwarded some tabulated results of sugar boiling worked out on the basis of gas at 2s. per 1000 cubic feet; and from these the following figures have been taken. Using 28 lbs. of white granulated sugar, with the addition of 8¼ lbs. of water, with a 10 minutes' boiling, and gas at 50 inches pressure, the temperature was raised to 310° Fahr., with a consumption of 40 cubic feet of gas. Thus the gas consumed per pound of sugar was 1·43 cubic feet; the cost per boil, 0·96d.; and the cost per cwt., 3·84d. For 28 lbs. of white granulated sugar, with the addition of 9 lbs. of water, for a 16 minutes' boiling, and gas at 70 inches pressure, the temperature was raised to 350° Fahr., with a consumption of 66 cubic feet of gas. The gas consumed per pound of sugar was 2·36 cubic feet; the cost per boil, 1·58d.; and the cost per cwt., 6·32d. It is added that one furnace would be capable of carrying out from 25 to 35 boils per day, according to the temperature and time required. For a boil of 28 lbs. of white granulated sugar and 12 lbs. of glucose, with 9 lbs. of water added, with a 17 minutes' boiling, and gas at 50 inches pressure, the temperature was raised to 310° Fahr., with a consumption of 65 cubic feet of gas. Thus the gas consumed per pound of sugar and glucose was 1·57 cubic feet; the cost per boil, 1·51d.; and the cost per cwt., 4·04d. For 28 lbs. of white granulated sugar and 12 lbs. of glucose, with the addition of 9½ lbs. of water, for a 30 minutes' boiling, and gas at 70 inches pressure, the temperature was raised to 320° Fahr., with a consumption of 90 cubic feet of gas. The gas consumption per pound of sugar and glucose was 2·25 cubic feet; the cost per boil, 2·16d.; and the cost per cwt., 6·05d. With this mixture, one furnace would be capable of carrying out 20 to 35 boils per day, according to temperature and time required.

To obtain the best results working with pressures of from 50 to 100 inches, in the event of the sugar requiring the same amount of heat throughout the boil the pressure would be retained at 50 inches. If the boil needed to finish at a great heat, the pressure would be increased from 50 inches upwards, until the desired temperature was reached. Should the sugar require to be quickly boiled at the beginning of the operation, the pressure would be started at (say) 100 or 75 inches, and then gradually reduced to 50 inches. For working sugars of the latter description, a pressure-gauge is fixed over each boiler; the pressure being controlled by a screw-down valve, according to the peculiar circumstances. Thus the mean pressure at the compressor would be 100 inches, if it was necessary to work at this pressure at any part of the process.

In addition to the nine boilers arranged for at the Maidstone factory of Messrs. Sharp and Co., installations have been fitted up in several large factories for manufacturers in the area of supply of the Commercial Gas Company and other parts of the country. The licensees for the Tooth sugar boiler are, it may be mentioned, the Vulcan Stove Company, of Exeter.

THE "COALOGAS" FIRE.

THE use of gas for lighting coal or coke fires has been heard of before, although not much used. But the lighting devices that have been introduced for the purpose have usually had something of a makeshift appearance about them, and have looked somewhat incongruous as an adjunct to the coal fire. Ordinarily they have taken the form of a burner that could be swung under the fire-grate, and away again when the fire has been lighted; so furnishing a continuous eyesore. But now Mr. Arthur Preen, of Crown Works, Cricklewood Lane, N.W., comes along with an ingenious patented device that is at once intended



The Burner in Position for Lighting a Coal Fire.

to be a permanent fixture in the fire-grate itself, and to render dual service to the householder who applies it. It can be employed as a means of lighting (without the use of firewood and paper) or of reviving a solid fuel fire; or when a large fire is not required, or a fire is needed temporarily (say, for a meal), or in case of an emergency, the fire lighting base and burner supplies the seat for the accommodation of a neat columnar fuel gas-fire. In other words, the user of this fitting saves the labour and trouble attached to lighting fires in the conventional manner, and is occasioned no vexation over a fire that shows a disposition to be recalcitrant in lighting up. The lighting of the gas is a sufficient assurance that the fire will "go." But beyond this, the user can please himself as to whether he shall have a coal or coke fire or a gas-fire; and he has at command the ready comfort of the latter. The arrangement can be applied to any ordinary grate; it is simple to instal; and its cost is modest.

The base of the burner is a heavy casting, with the gas-supply pipe passing to it through the bottom of the grate. Iron connections must be used on account of the heat of the fire. The casting is 10 in. by 3½ in.; and the top and one side are open. The back of the casting serves as a chamber for the gas and air mixture for feeding the tubular burner which is accommodated in bearings in the recess provided by the open front of the casting. The gas nozzles are formed in a solid piece at the top of the burner; and, the barrel being free to work in the end bearings to the extent of the travel allowed by projections (forming rests) on either side, the nozzles can be turned in the direction required—to the front of the grate when needed for lighting-up a coal or coke fire, or upright when the gas-fire is to be set on top of the burner. There is a row of strong pegs cast along one side of the burner-tube; so that when the burner is turned in the direction for lighting a coal or coke fire, the pegs assist to keep the solid fuel free from the burner-holes. The objection will at once be raised that the burner will be liable to choking by ashes and coal dust. The burner-nozzles being in a lateral direction when used for a solid fuel fire, there is really no trouble in this respect; and if perchance the burner should get blocked up, the tube, being removable, has only to be lifted out of the casting, and any dust in it emptied out. A coal or coke fire quickly lights up by the use of the arrangement.

There is next the use of the casting and burner for a gas-fire. First of all there is an enamelled base, with an oblong aperture in the top. This base is simply set by hand on top of the burner casting; the burner tube having been turned so that the gas-flames will be vertical. On to this ornamental base is set the casing containing the columnar fuel; this being held in position on the base by supporting projections at either end. The fuel casing is only about 8 inches wide by 7 inches high; and it contains six columns of fuel, the full height of the casing. When in use, the whole surface is incandescent. The fuel itself is freely open in front; the back is flat, with internal projections upon it, and each column has in it at the back some half-dozen perforations. Then, between the rear of the fuel and the casing, there is a sheet of asbestos packing. From this explanation it will be gathered, that there is nothing more about the fuel casing than is sufficient to keep the fuel in position and protect it, and to present the largest amount of radiating surface possible from a fire that the user is able to move in and out of position as he desires. The only criticism we have to make is the prominence given on the little canopy to the lettering "Preen's Patent." It detracts from the refinement of the useful (if small) gas-fire. A plain canopy or a little ornament would look much better. Of course, for numerous positions there can be no objection; but we should not like a gas-fire with the makers' name in obtrusive relief on the most prominent part of the fire in (say) a drawing or dining room. That by the way. It is a matter easily remedied; and perhaps all the castings are not the same. We have omitted to mention that the consumption of gas is from 15 to 18 cubic feet per hour according to the pressure.

The Burner with Gas-Fire on Top.

There is a large field of usefulness for this arrangement in the country's coal-grates in rooms where the residents have a preference for the solid-fuel fire for long-hour service, and yet would like to be enabled to themselves place a gas-fire in position for use as and when temporarily required.

CONCILIATION IN LABOUR DISPUTES.

NOTICE has already been taken in the "JOURNAL" of the first part of the Board of Trade report dealing with industrial disputes in 1911, which was lately issued by Mr. G. S. Barnes, of the Labour Department. This portion of the report referred to strikes and lock-outs; while the second part, to which reference may now be made, gives particulars of the work accomplished during the twelve months by Conciliation and Arbitration Boards.

As has already been shown, the year 1911, like its predecessor, was marked by considerable industrial disturbance, the total number of people involved in disputes approaching a million. It is remarked by Mr. Barnes that conciliation or mediation entered very largely into the settlement of the big disputes of the year; the total number of workpeople directly involved in disputes in which settlements were effected during 1911 by conciliatory efforts under the Concilition Act, 1896, and in other ways being 348,333. Settlements by arbitration affected only 7435 workpeople. As in other recent years, many disputes were settled during the period under review by conciliation or arbitration without stoppage of work—the number of cases settled by voluntary permanent boards of conciliation and standing joint committees showing an increase for the fourth year in succession. Of the 903 disputes which began in the year 1911, 105 (directly involving 527,929 workpeople, or 64 per cent. of the total directly involved in all the disputes of the year) were settled by conciliation—*i.e.*, by the mediation of a third party or board—or by reference to arbitration. A certain number of the disputes taking place in 1911, were, however, settled in 1912; so that the figures just quoted are not an exact record for the year of the disputes settled by the means named. The number of cases settled by conciliation or arbitration last year in the metal, engineering and shipbuilding, textile, and miscellaneous trades (as well as transport) was in excess of the average for the period 1902 to 1910.

The actual number of strikes and lock-outs settled by conciliation or arbitration during 1911 was 92, which compares with 59 for the preceding year, and only 27 for 1902. In these settlements last year, the number of workpeople both directly and indirectly involved was 374,363—far more than in any other twelve months during the past ten years. Of the 92 cases settled in the period under review by conciliation or arbitration, 70 were arranged by conciliation and 22 by arbitration. There were 32 of them settled under the Conciliation Act of 1896; this comparing with 15 disputes so settled in 1910. In 23 of the cases last year, the disputes were settled by conciliation, under the Act referred to; and in 9 cases by arbitration. As has been shown, therefore, there was a considerable increase in 1911 in the number

of disputes settled by conciliatory agencies. As a matter of fact, the number of cases settled by these means was in excess of that for any previous year, and was more than double the average for the nine years 1902 to 1910. One of the great features of the disputes which were terminated in a conciliatory manner last year was the great predominance of the number of cases settled by conciliation over those terminated by arbitration. The 22 disputes which were wholly settled by arbitration directly involved 7435 workpeople; whereas the 70 disputes which were settled by methods of conciliation directly involved 348,333 workers. The number of disputes settled under the Conciliation Act, 1896, was the highest recorded for any year since the Act came into force—the settlements effected by mediation in connection with disputes in the transport trades being mainly responsible for this.

The foregoing figures, of course, refer solely to the disputes in which an actual stoppage of work occurred, whether or not permanent boards of conciliation were involved. The main part of the work of these boards, however, consists in the prevention of strikes and lock-outs; and to this aspect of the question the following particulars refer. The number of voluntary permanent conciliation and arbitration boards and standing joint committees known to have taken action in 1911 was 126; and the number of cases considered by them was 4543, as compared with 1971 cases considered by 109 boards in 1910. Of the 4543 cases considered last year, 3259 were settled by the boards or their committees, and 289 by umpires or arbitrators appointed by them. Of the large number of disputes thus settled, only 13 cases involved stoppage of work; and 6 of these cases occurred in the coal mining industry. In 789 cases, the questions in dispute were withdrawn, ruled out of order, or settled independently; in 26 instances they were referred to higher boards; and the remaining 180 cases were still under consideration at the end of the year. During the year, a large number of cases arising at individual collieries were again dealt with by the Joint Committees in the Northumberland and Durham coalfields, though the number settled by them was somewhat under the average of the preceding nine years. No less than 2488 cases were dealt with by the Tinplate Conciliation Board; but the great majority of them affected only a few workpeople. On the other hand, one case dealt with by the Board for the coal trade of Monmouthshire and South Wales affected about 190,000 workpeople. Various new boards were formed during the past year; and a fair number ceased to exist.

SEWAGE SLUDGE FOR MAKING GAS.

Those of our readers who are familiar with "King's Treatise on Coal Gas" will probably remember that at the close of the chapter on "The Production of Illuminating Gas from Material Other than Coal," in the third volume, it was mentioned that attempts had been made to utilize sewage sludge for the purpose named. Particulars are given of an investigation carried out by Mr. T. Collinge, at Rochdale, with the result that, taking sludge containing 2·1 per cent. of nitrogen, and with 9·14 per cent. of moisture, and carbonizing it in retorts in six-hour charges of 4 cwt. each, he could get from a ton a yield of only 56·96 cubic feet of gas, which was reduced by purification to 46·69 cubic feet. The gas, moreover, was non-luminous. The conclusion arrived at was that the value of sewage for gas making, even when it was reduced to the form of sludge having the small proportion of moisture stated, was practically *nil*. In view of the unfavourable results of the experiments referred to, it may be of interest to give an account of what has been done, in the direction named, by the authorities of Brünn, the capital of Moravia—a city of 130,000 inhabitants. This we are able to do from a paper prepared for the last congress of the Société Technique du Gaz en France by M. Léonce Fabre, of Marseilles.

The quantity of sewage discharged per day at Brünn is about 23,000 cubic metres, or rather more than 5 million gallons; and according to an average of 950 analyses made by Professor Hönig, each cubic metre (220 gallons) contains 1666·4 grammes of solid substances, composed of ash, fatty matter, and nitrogen, in the proportions of 41·95, 4, and 2·86 per cent. Taking these data into consideration, it became a question whether it would be advantageous to utilize the sewage as a manure, as a fuel for heating purposes, or as an artificial coal for the production of illuminating gas. An average of 75 analyses of the dried sludge showed that it contained combustible matter, free from ashes and moisture, of the following percentage composition: Carbon, 52·97; hydrogen, 6·44; oxygen, 35·7; nitrogen, 4·89. Its heating value was 4963 calories per cubic metre. It seemed, therefore, that there would be special advantage in treating the sludge with a view to utilizing its calorific power and its nitrogen, easily recoverable in the form of ammonia. Gasification in retorts appeared to solve the problem in a reasonable manner, conditionally upon the almost complete drying of the sludge in the shortest possible time. It was consequently necessary to instal a powerful filtering appliance of considerable productive capacity; and this was found in a continuous machine constructed by Herren Abt and Beyer, which is fully described and illustrated in M. Fabre's paper. With this machine, which requires but little motive power to drive it, it is possible to obtain per hour and per square metre of filtering surface 33·3 kilos (73 lbs.) of thick sludge, containing 22·5 per cent. of dry matter—that is to say, 7·5 kilos. of anhydrous mud—from an initial liquid mud containing only 3 to 4 per cent. of dry matter. The mud is produced in the form of thin flat pieces, which are found to be the most convenient for drying. Experience has shown that the distillation of damp sludge, with or without the addition of coal, does not give satisfactory results from the point of view of the calorific power of the gas produced, the yield of ammonia, &c. The pasty sludge must be dried and distilled in retorts similar to those used for making coal gas. Drying, however, is easily effected with known types of appliances.

Gasification of the sludge has been studied in detail in a series of experiments carried out at the Brünn Gas-Works, where one of the retorts in a setting was isolated, and the gas produced was conveyed to the experimental station to be purified and measured. With complete carbonization, extending over a period of 2½ hours, a charge of 55 kilos. (121 lbs.) of dry sludge produced at the rate of 28 cubic metres (990 cubic feet) of gas per 100 kilos (220 lbs.) after purification. Comparing the sludge gas with ordinary coal gas as made at Brünn, it was found to have almost as great calorific power and a higher photometric value. The following figures show the composition of the gases:—

	Sludge Gas, 1907.	Sludge Gas, 1508.	Brünn Coal Gas.
Carbon dioxide	2·2	2·2	2·2
Heavy hydrocarbons	4·8	7·8	3·1
Methane	18·1	23·2	26·8
Carbon monoxide	17·5	16·4	11·1
Hydrogen	44·6	41·7	50·0
Oxygen	0·8	0·8	0·6
Nitrogen	12·0	7·9	6·2
	100·0	100·0	100·0
Calorific power	4122	4759	4950

As regards illuminating power, tests made with Brünn gas, consumed in a batswing burner at a pressure of 41 mm. (16-10ths), gave the carcel (say, 9·6 candles) with a consumption of 130 litres (4·6 cubic feet), whereas the sludge gas gave it with only 55 litres (1·9 cubic feet). Among the rich hydrocarbons contained in the gas, there is certainly benzol; but ethylene and acetylene appear to be the principal constituents.

The temperature of the retorts need not be so high with sludge as with coal. In the experiments, it was only from 600° or 700° C. (1112° to 1332° Fahr.). Vertical retorts are preferable for carbonization, as there is a considerable decrease in the quantity of tar and a greater production of gas. If the dry sludge is compressed, at 100 or even at 50 atmospheres, into briquettes, from 25 to 30 per cent. more of it can be put into the retorts. The starting of the distillation process will, however, be slightly delayed. The quantity of ammonia produced was 0·957 kilo. per 100 kilos. of sludge, or three or four times as much as it would have been with the same weight of coal. The resulting coke was in the form of small pieces; and the yield was from 52 to 63 per cent. of the material employed. Its percentage composition was as follows:—

	No. 1.	No. 2.
Water	—	3·72
Carbon	26·65	27·50
Hydrocarbon	0·62	0·90
Oxygen	2·50	2·47
Nitrogen	0·65	0·67
Ash	65·78	65·58

Calorific power: No. 1, 2200; No. 2, 2400.

To convert the pasty mud from 25 per cent. into 85 per cent. of dry matter, it is necessary to employ 37,800 calories per 100 kilos. This quantity yields in dry distillation 14·5 kilos. of coke having a heating power of 2300 calories per kilogramme, which represents a total of 33,350 calories. If only 60 per cent. of this heat is used for drying, the combustion of the coke will give 23,300 calories—that is to say, 61 per cent. of the heat required for complete desiccation. Moreover, the waste heat from the retort furnaces can be utilized. For the gasification of 100 kilos. of dry mud, corresponding to 400 kilos. of pasty mud, 16 kilos. of coal coke are needed—*i.e.*, 4 kilos per 100 kilos. of pasty sludge. The volume of gas produced by the combustion of this coke will be 9·05 cubic metres per kilo. This gas, which has a specific gravity of 1·3 and a specific heat of ·25, represents a heating capacity of 2·9 calories for 1° C. As the gas issues at about 700° C., there are 8120 calories for the 4 kilos. of coke. If only 30 per cent. of this heat is used for heating the air in the drying apparatus, there are 5684 calories, or 15 per cent. of the total necessary heat, available for this work. The remainder—about 9000 calories—required to dry 100 kilos. of pasty sludge is to be obtained from the combustion of about 2 kilos. of ordinary coal, coke dust, or trade waste.

According to the proportion of dry sludge collected at Brünn, the gas-works will have to distil 37 metric tons per day to produce 9000 cubic metres (317,854 cubic feet) of gas of 4500 calories per cubic metre, and (reckoning only an average yield of 0·750 kilo. per 100 kilos.) 277 kilos. of ammonia, representing a yearly value of 31,000 frs. (£1240). All these considerations have led the municipal authorities to adopt the Hönig and Bayer system for the purification of the sewage. The results obtained at the experimental station established when the investigation of this question was commenced, were so satisfactory that the municipal purification works were authorized as being of the greatest utility. The process was considered to be the one best calculated to meet almost the whole cost of treating sewage, completely destroy the mud, and facilitate either septic purification or the irrigation of very small areas with the clarified liquid.

Taking the purification works at Brünn as a basis, the following

is a rough estimate of the cost of an installation of plant for dealing with the sewage of a town of 100,000 inhabitants:—

Cost of Works and Plant.

	Francs.
Land, buildings, reservoirs, &c.	600,000
Two filtering appliances and accessories	30,000
Drying plant	50,000
Total	680,000

Annual Working and Maintenance Charges.

	Francs.
Interest and sinking fund, 6 per cent. on 680,000 frs.	41,000
Labour	21,000
General expenses	10,000
Lubrication, &c.	3,000
Motive power (60 H.P.)	11,000
Coal for drying	7,000
Sundries	10,000
Total	103,000

With 100,000 inhabitants, reckoning 120 litres of sewage per inhabitant per day, we have 12,000 cubic metres (2,880,000 gallons) of sewage, with 1·5 kilos. of sludge per cubic metre (220 gallons)—viz., 18,000 kilos. This gives per annum 18,000 × 365 = 5570 metric tons, which at 19 frs. per ton works out to 105,830 frs., or 105,000 frs. in round figures.

Among the advantages claimed for the Hönig-Bayer process, so far as municipalities are concerned, is this—that when the population of a town increases, all that is necessary is to employ additional filtering plant and increase the drying apparatus. This cannot involve such a strain on the financial resources of a municipality as the purchase of more land for receiving the sewage or lengthening the main sewer would do. From the point of view of the supplier of gas, it is easy to form an estimate of the advantages companies can, in many instances, derive from this process, by coming to the aid of municipalities who have but imperfectly solved the unpleasant problem of sewage disposal. Assuming that French towns having populations of more than 15,000 inhabitants (representing a total of 15 million people) are sewered, and that the sludge obtained is dealt with by the process described, there would be, according to the figures given, a daily production of about a million cubic metres (35·3 million cubic feet) of gas, and 45 metric tons of ammonia, or 180 tons of sulphate, the total value per diem being represented by 220,000 frs. (£8800). Thus 3500 metric tons of coal, worth 70,000 frs., would be saved daily, while the municipal health authorities would be able to preserve the rivers and streams from pollution, and ensure the perfect sanitation of their towns.

The subject of M. Fabre's paper had been previously dealt with by him in the "Journal des Mécaniciens" of Marseilles; and the results recorded were criticized by M. Grebel some months ago in the "Journal de l'Eclairage au Gaz." He pointed out that there were some serious errors in the figures given, and, moreover, no information was furnished in regard to the consumption of fuel for drying and heating. M. Grebel returned to the subject in a recent issue of our Paris contemporary, in connection with an article by M. Cavel in the "Génie Civil," in which the latter stated that he had carbonized at a red heat, after drying to a constant weight, sludge from the septic tanks at Mont-Mesly, belonging to the department of the Seine, where something like 4,850,000 gallons of sewage are treated daily, and yield at the rate of about 11 oz. of dry sludge per 220 gallons. The yield obtained in the laboratory per ton of dried sludge was only 42·3 to 81·7 cubic metres (from 1490 to 2880 cubic feet) of gas, of feeble illuminating power, and of 3500 calorific value per cubic metre (about 400 B.Th.U. per cubic foot). It had the following composition:—

	Per Cent.
Sulphuretted hydrogen	15·55
Carbonic acid	2·53
Oxygen	3·54
Hydrocarbons	0·56
Carbonic oxide	27·43
Methane	24·48
Hydrogen	9·60
Nitrogen and difference	16·31
	100·00

M. Grebel remarks that, from a hygienic point of view, it would be interesting to be able to destroy, or at all events to mineralize, the residual mud resulting from the biological treatment of sewage. From the commercial point of view, however, he will continue to doubt, unless it is proved to the contrary, that sludge gas can be obtained economically, in view of the cost of heating and drying and the low yield of the sludge, especially if it is necessary to free the gas from its high content of sulphuretted hydrogen before utilizing it for incandescent lighting or for motive power. He concludes by calling attention to the use of septic tank gas for the latter purpose at Parramatta, of which some particulars were given in the "Journal" for the 18th of June last (p. 897). The Chief Engineer of Irrigation (Mr. L. A. B. Wade), reported that a 4-H.P. engine, which was originally run with petrol, worked without a load as smoothly with the tank gas as with that produced from petrol. This result induced the Engineer of the Municipal Council to put in an engine of higher power.

In connection with this subject, it may be of interest to direct attention to a paper on "Sewage Sludge and its Disposal," read by Dr. J. Grossmann before the Manchester Section of the Society of Chemical Industry some months since.

REORGANIZATION OF THE PHOTOMETRICAL COMMISSION.

In connection with the article on the "Composition and Work of the Photometrical Commission" which appeared in the "Journal" a fortnight ago (p. 890), it may be of interest to give an indication of the nature of the report presented at the annual meeting of the American Gas Institute by the representatives of the Institute who attended the last conference of the Commission, which was held at Zurich in 1911.

The Committee remind the members that at the meeting of the Institute in 1911 a paper was presented by Mr. C. O. Bond, entitled "A Survey of American Gas Photometry." It was partly in the nature of a report on the organization and work of the International Photometric Commission and formed the basis for certain resolutions contained in the "Report of the Committee on Thermal Power and Candle Power." The Committee said they were not then prepared to make any definite recommendation in view of the experimental work in progress in America and foreign countries. Further time should, they thought, be allowed for the investigation of the important questions involved in the testing of the thermal values and candle power of gases of varying composition. They, however, expressed their wish to endorse the several recommendations contained in Mr. Bond's paper, which were as follows:

1.—That this Institute promptly appoint three delegates to the International Photometric Commission, these delegates to be prepared to undertake individual investigations to be reported at the next congress of this Commission; the officers of this Institute to notify the President of the Commission of the appointment of the Institute's delegates, so that they may be assigned to such investigations as may be considered advisable by the President of the Commission. The Institute's delegates to report progress to this Institute at its next convention.

2.—That the Secretary of the Institute be instructed to prepare a report of the proceedings of the three sessions of the International Photometric Commission thus far held; this report to be incorporated in the proceedings of this Institute, preferably in the next volume.

In pursuance of the first resolution, which was unanimously accepted, the President (Mr. Ira C. Copley) subsequently appointed the following three members to serve as a Committee of Representatives to the Photometric Commission—Mr. C. O. Bond, Mr. J. M. Morehead, and Mr. E. P. Hyde (Chairman). With the consent of the Institute, the Committee defer for the present year any report of the progress on the actual scientific or technical work undertaken or contemplated, and confine their report to the consideration of certain important questions which have arisen in connection with the reorganization of the Commission.

Unfortunately the advanced unofficial report of the last session of the Commission (1911) which served as the basis for the Institute's resolution to appoint a Committee of three representatives was incorrect; so that at present there is no authority according to which the Institute may have more than one delegate. Inasmuch, however, as there will probably be an entire reorganization of the Commission before the next session, and it would seem desirable that the Directors of the Institute, in determining the attitude of that body towards the proposed plan of reorganization, should have the advice of a Special Committee rather than that of any single individual, the Committee recommended that the incoming administration should be given authority to appoint a Committee of three or more members to serve as an Advisory Committee under the chairmanship of the one appointed as the official delegate to the Commission.

The resolution regarding the enlarged representation which was actually passed by the Commission at the last session, together with other resolutions of importance, is contained in the official letter, dated Jan. 12, 1912, from M. Th. Vautier, the President of the Commission, to Mr. Copley. A copy of this letter is given in the report. [See Appendix I.] The Committee point out that the various resolutions regarding organization passed by the Commission cannot become effective until they have been endorsed by the national technical gas societies forming the Paris Congress who created the Commission; and it was for the purpose of securing the approval of the four resolutions passed at the last session that the letter from M. Vautier was forwarded to the President of the Institute.

The letter was taken into consideration by the Directors of the Institute, with the advice of the Committee of Representatives. The conclusions arrived at are embodied in the letter of May 1, 1912, from the President to M. Vautier, a copy of which is appended. [See No. II.] It was carried by the Chairman of the Committee (Mr. E. P. Hyde), and presented personally to M. Vautier at Lyons on May 31, 1912. On the way, advantage was taken of the opportunity to discuss the proposals of the Institute, as contained in the President's letter, with representatives of the gas and electric lighting interests, of the national laboratories, of the London Illuminating Engineering Society, and with other prominent individuals in the field of photometry and illumination in England, France, Germany, and Holland. An unsuccessful effort was made to bring the matter personally to the attention of the Austrian delegates to the Commission; and limited time prevented the carrying-out of the intention to do so in the case of the representatives of Italy and Switzerland. Before the journey to Europe was undertaken, the attitude of the other lighting interests in

America was thoroughly canvassed, as explained in Mr. Copley's letter to which reference has been made.

The outcome of the proposals of the Institute is clearly set forth in the two appended copies of letters [Nos. III. and IV.]—one being the reply of M. Vautier to Mr. Copley's letter, and the other a general letter which has been sent in the form of a report to each of the foreign representatives with whom the proposals were discussed. These two letters, read in conjunction with Mr. Copley's letter to M. Vautier, will explain fully the American proposals, and indicate the welcome accorded them. The Committee express the hope that the plan of reorganization of the Commission may come to a successful issue, and a truly international and thoroughly representative body be formed.

In conclusion, the Committee bring before the Institute a suggestion that the time is ripe for the organization of an International Gaseo-Technical Commission that will be co-ordinate with the International Electro-Technical Commission, which has already accomplished excellent results for the electric industry, and with the proposed new International Photometric Commission, which it is hoped will accomplish similar results for all lighting interests, both gas and electric.

APPENDICES.

No. I. [*Translation.*]

Lyons, Jan. 12, 1912.

To the President of the American Gas Institute.

Mr. President,—I have the honour to bring to your attention the following resolutions adopted by the International Photometric Commission at its last session, of which it solicits the approval of your Society as well as that of the various technical gas societies who founded it in 1900. It hopes that your Society will ratify these resolutions, which it has unanimously adopted, because it considers that their realization is necessary for the development and satisfactory progress of its work.

1.—The technical gas societies of Germany, England, the United States, and France represented in the International Photometric Commission shall each have the power to name representatives for its country to the number of six. Those of Austria-Hungary, Belgium, Holland, Italy, and Switzerland shall have each the power to name representatives for their countries to the number of three.

2.—Votes shall be taken by countries, each country having one vote.

3.—A decision shall require four-fifths of the votes cast in order to be presented as coming from the Commission.

4.—In view of the discussions of questions of common interest to the gas and electrical interests, the Commission will request the National Electro-Technical Committees to name delegates to the extent of two each for Germany, England, United States, and France, and to the extent of one each for the other countries represented in the Commission.

Apart from the considerations in virtue of which the Commission has adopted the resolutions indicated above, a recent occurrence gives a particular interest to the admission into the Commission of a certain number of members representing electric lighting. Your Society must have received, without doubt, a letter from the Illuminating Engineering Society of New York which solicits the co-operation of your Society in the calling of an international conference for selecting the terms to be employed in the art of illumination, as well as the nomenclatures and notation to be adopted.

This Society is without doubt unaware that the International Photometric Commission has taken the initiative in adding to itself members representing electric lighting; and it is hoped that when it is so informed it will renounce its project. But, in any case, permit me to call the attention of your Society to the inconvenience which will result in case it approves the calling of a special conference for the consideration of a question which is essentially within the province of the International Photometric Commission. Granting that in the future the representatives of electric lighting shall have a satisfactory place, we strongly hope that the technical gas societies which in 1900 founded the International Photometric Commission, and which have given it their support since then, will continue to give it their confidence, and will reply to the Illuminating Engineering Society that they consider it useless to call an International Conference for the proposed questions, which come within the domain of the International Photometric Commission.

I wish to inform you still further that the Committee on Nomenclature and Standards of the Illuminating Engineering Society contains four members who are members of the International Photometric Commission—viz., Dr. H. Bunte, of Carlsruhe, Mr. E. P. Hyde, Professor Vivian B. Lewes, of London, and Mr. C. C. Paterson, of the National Physical Laboratory of England. Surely these persons have not been especially designated by the Illuminating Engineering Society to represent it in the International Photometric Commission. This does not prevent them from being a bond of union between this Society and the International Photometric Commission, if the circumstances require it. Moreover, the nomination of representatives of electric lighting which the International Photometric Commission hopes soon to be able to request of the National Electro-Technical Committees will give to the Committee of the United States the opportunity to appoint two members; and, assuming the relations which ought to exist between this Committee and the Illuminating Engineering Society, it is evident that their choice will give full satisfaction to this Society.

It should be noted also that the International Photometric Commission is not composed exclusively of representatives of gas lighting. It has also among its members physicists and electricians, such as Dr. Brodhun, representative of the Imperial Physical Technical Institute of Germany; M. Laporte, Sub-Director of the Laboratoire Central of Paris; Mr. C. C. Paterson, representing the National Physical Laboratory of England; Mr. E. P. Hyde, of the National Electric Lamp Association; and M. Lauriol, Engineer-in-Chief of the Lighting Service of the City of Paris.

Finally, at its last session, the International Photometric Commission, at the request of M. Blondel, has considered the proposals made in November, 1910, by the Committee on Nomenclature and Standards of the Illuminating Engineering Society concerning photometric magnitudes and units. It has named, to report to it at the coming session, a Sub-Committee composed of Dr. Brodhun, M. Laporte, Mr. C. C. Paterson, Mr. E. P. Hyde (already named), and Dr. Kusminsky, the Superior Inspector of the Bureau of Standards of Austria-Hungary. This Sub-Committee could be enlarged subsequently, if it is necessary when the number of the members for the International Photometric Commission is increased.

It follows from the preceding considerations that, if the technical gas societies approve of the addition of the representatives of electric lighting, they will give to the International Photometric Commission a still greater and more extended authority to consider those photometric questions on which an international agreement is necessary. It appears, therefore, inopportune actually to create a new organization to consider the question suggested by the Illuminating Engineering Society.

Regarding the resolution of the Commission relative to increasing the number of its members to be designated by the technical gas societies, as soon as they, as well as your own Society, shall have replied, I will inform you, in order that your Society may avail itself of its right to appoint new members.

Having had the opportunity to participate in the meeting of the Committee of the Société Technique which met in Paris in the last quarter of 1911, I transmitted these resolutions, which were completely approved. The Committee has, moreover, expressed the view that in order to recognize the services rendered to the Commission or those which they may be able to render in the future, the representatives of the Reichsanstalt, of the National Physical Laboratory, of the Laboratoire Central, of the Bureau of Standards at Washington, and of the International Bureau of Weights and Measures, shall have the right to take part in the Commission as titular members, in addition to the six representatives which Germany, England, United States, and France shall have each the power to nominate. The Committee has charged me to present to you this proposition, which I heartily endorse.

It would very much oblige me if you would reply as soon as possible.

(Signed) TH. VAUTIER.

No. II.

May 1, 1912.

To M. Vautier, President, International Photometric Commission.

Sir,—In further reply to your letter of Jan. 12, I have the honour to submit the following views and resolution of the Board of Directors of the American Gas Institute regarding the extended representation and functions of the International Photometric Commission.

The Directors of the American Gas Institute are in perfect accord with the International Photometric Commission in its desire to extend its representation in such a manner as to make it representative of the electrical as well as of the gas lighting interests, as is necessary for the development and satisfactory progress of the work of the Commission. Moreover, the Directors of the American Gas Institute are of the opinion that the initiative in bringing about an international agreement on photometric nomenclature and standards should rest with the International Photometric Commission, which is a well-organized international body that has been concerned almost entirely with photometric questions. It is the opinion of the Directors of the American Gas Institute, however, that the largest and most permanent results will be attained if the policy initiated by the International Photometric Commission in its resolution to invite representation of the National Electro-Technical Committees be extended in such a way as to make the International Photometric Commission thoroughly representative of all lighting interests on equal or mutually acceptable terms, including the Illuminating Engineering Societies of this country and England, in addition to the national laboratories, the technical gas, electric, acetylene, and other associations.

There are at present at least two independent projects looking to the convening of such a thoroughly representative international conference on nomenclature and standards: (1) That initiated by the Illuminating Engineering Society in America, and endorsed by various technical bodies, both in that country and Europe; and (2) that initiated by the London Illuminating Engineering Society and endorsed by the Turin Electrical Congress. The first project contemplates merely a conference on nomenclature and standards. The second, on the other hand, looks towards the establishment of a permanent commission on illuminating engineering, of whose functions the consideration of questions of nomenclature and standards would constitute but a part.

The Directors of the American Gas Institute have undertaken to determine the attitude of other technical bodies in the United States regarding their willingness to support the International Photometric Commission, and to accept its findings. As a result of their canvass, it was concluded that, though there was a willingness on the part of the other lighting interests in America to support the International Photometric Commission as far as possible, yet, owing to the insufficient representation of some of the lighting interests under the proposed organization of the Commission, it could not be expected that this Commission would receive the recognition that should be accorded to an international body organized to bring about international unity in photometric nomenclature and standards. The opinion which was reached by the Board of Directors of the American Gas Institute in this connection is set forth in the following extracts from the minutes of their meeting on the 24th of February.

> "(1) That it is the sense of the Board of Directors of the American Gas Institute that the formation of a more fully representative International Committee to fix on the nomenclature and standards relating to all questions of photometry is desirable. (2) That they approve of the suggestion of an enlargement of the representation to the International Photometric Commission to include all photometric interests on equality of representation. That if the International Photometric Commission deem it unwise to make such enlargement of representation, preferring to remain an International Gaseo-Technical Commission only, that the International Photometric Commission take the initiative in issuing a call to all the principal photometric interests to participate in the formation of a representative international commission to deal

with all questions of nomenclature and standards of use in photometry."

This motion was put and seconded, and then opened for discussion; and, after discussion, it was put to the vote and approved.

Under the conditions of the first alternative, the International Photometric Commission would cease to be responsible to the national technical gas societies alone, and would become responsible to all photometric interests represented in the Commission. It would become a more important body than at present, and might very properly develop into such a commission on illumination as contemplated in the resolution passed by the Turin Electrical Congress, endorsing the proposal made by the London Illuminating Engineering Society. Under the conditions of the second alternative, the International Photometric Commission would restrict its deliberations to questions of purely gas interest. If such were the case, it would still be highly proper for the Commission to take the initiative in calling such a representative international conference on photometric nomenclature and standards as is contemplated in the proposal of the Illuminating Engineering Society of America.

These views of the Directors of the American Gas Institute, as crystallized in this resolution, were presented to the various technical societies in this country that are peculiarly interested in photometry. The Illuminating Engineering Society has subscribed to the views expressed in this resolution of the American Gas Institute, and passed a resolution to hold in abeyance its project of convening an International Conference this year. Other technical lighting bodies in the United States have subscribed to the same views. The American Gas Institute, therefore, as an adhering and supporting member of the International Photometric Commission, desires to present this resolution as the expression of views which are acceptable to all the prominent photometric interests in this country.

This letter will be presented to you by Mr. Edward P. Hyde, who will represent the American Gas Institute in furthering the proposals made herein.

(Signed) I. C. COPLEY,
President, American Gas Institute.

No. III. [*Translation.*]

To Mr. Ira C. Copley, President, American Gas Institute.

Lyons, France, June 5, 1912.

Mr. President,—I have the honour to inform you that I am in receipt of your letter of the 1st of May, which was delivered to me on the 30th of May by Mr. E. P. Hyde, in discussing with whom the views expressed therein I have had much interest and pleasure.

This letter discloses perfectly the situation created by the proposals of the International Photometric Commission, and by those which have been made since then; and it indicates well the two best plans to be followed for progress in photometric questions. My personal opinion is that the first plan is the better. It consists, as you indicate, in enlarging the International Photometric Commission so as to render it representative of all important photometric interests in a manner satisfactory to all, and such that there will be but one international body charged with the establishment of a nomenclature and standards, and with the investigation of all questions concerning photometry. I am completely in accord on this point. It would seem, moreover, from your letter, that this is the view of the Committee of the American Gas Institute and of the principal bodies interested in the question in the United States and likewise in Europe, if one judges from the conversations which Mr. Hyde has had with their representatives. Under these circumstances, it is expedient to seek without delay a practical means of arriving at the proposed result.

Mr. Hyde has thought, and I agree with him, that it would be desirable to refer this matter to the Sub-Commission already named last July by the International Photometric Commission to consider the proposals of the Illuminating Engineering Society of New York regarding nomenclature and units. This Sub-Commission would seem to be of such a nature as to give the guarantee of impartiality to all photometric interests. It is composed of Dr. Brodhun, M. Laporte, Dr. Kusminsky, Mr. C. C. Paterson, Mr. E. P. Hyde, and M. Th. Vautier.

In passing, I should add that Mr. Hyde has handed me his resignation as a member of the Sub-Commission. I have expressed to him all the regrets that I feel at his decision, so much the more so since his personal action has been manifested in a very useful way in the recent conferences both in America and Europe. But he has told me that his resignation had been suggested by the desire to leave the American Gas Institute entirely free to designate a representative in the Sub-Commission now that the latter has a new task to accomplish in the extension of the International Photometric Commission.

I propose to have copies of your letter of the 1st of May sent to the Sub-Commission, asking the latter to determine the practical means of arriving at the result proposed above, and to make a report on this question which I shall send to the various technical gas societies who have formed the International Photometric Commission.

The Secretary of the Sub-Commission will have to correspond directly with the members of this Sub-Commission in working-out the plan of enlargement of the International Photometric Commission pursuant to the views indicated, and also in establishing its principal functions.

I should have been happy to designate as Secretary the representative of the United States, but it has seemed to me better to choose a European member to assure greater expedition in the correspondence. I am planning to ask Mr. C. C. Paterson to accept these duties.

I am happy to note the evidence of interest that the American Gas Institute has manifested on this occasion in connection with the question which occupies us. In thanking it for the favourable action which it has recently taken, and for the mission which it has confided to Mr. Hyde, I pray you, Mr. President, to accept the expression of my most distinguished sentiments.

(Signed) TH. VAUTIER.

No. IV.

To the Chairman, Representatives of the American Gas Institute to the International Photometric Commission.

July 18, 1912.

Dear Sir,—It gives me pleasure to hand you enclosed a copy of the letter from President Copley, of the American Gas Institute, to President Vautier, of the International Photometric Commission, and a copy of the reply of President Vautier to President Copley. The first of these letters formed the basis of my conference with you during my recent visit to Europe in connection with the reorganization of the International Photometric Commission. The reply from President Vautier informs you of the final result of my mission, consisting in the endorsement by him of the first alternative presented by the American Gas Institute.

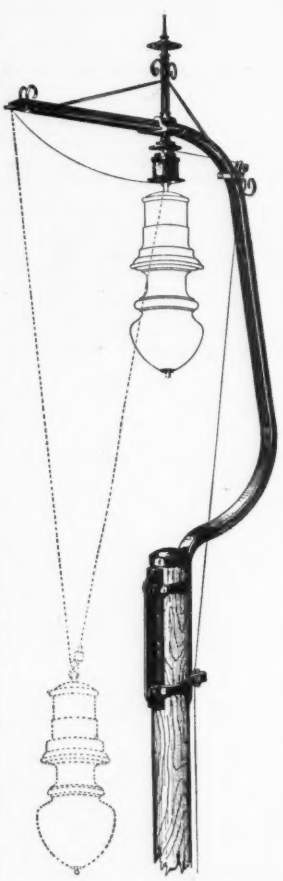
You will recall that the American Gas Institute proposed that the International Photometric Commission should modify its organization in either one of two ways: (1) To enlarge and reorganize the Commission in such a way as to make it truly international in character and thoroughly representative of all lighting interests; or (2) to retract from its proposal to invite delegates from the National Electro-Technical Committees, and to confine itself to matters of purely gas interest. The first of these two alternatives commended itself to nearly all representatives in Europe with whom I had the pleasure of conferring. This first alternative commended itself also to M. Vautier, the President of the International Photometric Commission.

You will note in President Vautier's reply the plan which will be pursued in putting into execution the first proposal made by the American Gas Institute. According to this plan, President Vautier will refer the letter from the American Gas Institute to the Sub-Commission on Nomenclature and Standards for consideration, having appointed one of the members of the Sub-Commission to act as Secretary.

It is expected that the Sub-Commission will be able to draw up a satisfactory plan of reorganization which the Secretary of the Sub-Commission will present to President Vautier, who in turn will submit the plan of reorganization to the various national technical gas societies who are at present adhering and supporting members of the International Photometric Commission. It is expected that the plan of reorganization which will be proposed by the Sub-Commission will be such as to include representatives of all the national laboratories, and of the physical, electro-technical, gaseo-technical, and illuminating engineering societies. It is further expected that the plan of reorganization will be such as to provide for sections on gas lighting, on electric lighting, and on any other questions which may be of sufficient importance to justify the formation of a special section. The Commission as a whole will consider all questions of general interest.

(Signed) EDWARD P. HYDE.

A SHADOWLESS ARC LAMP CARRIER.



In the accompanying illustration is shown a new shadowless "half lyre" arc lamp carrier which has recently been brought out by the London Electric Firm, of Croydon. It was designed to supersede, at reduced cost, jibs and swan-necks, ladders, climbing-irons, &c., for the lighting of railways, docks, quays, works, and other large open spaces. It is an adaptation of the firm's patent lyre-shaped centre carrier, and is adaptable for any size or kind of pole—wood, iron, or concrete. It is provided with their automatic connector and suspender, or with their safety catch only (a cheaper arrangement); either plan ensuring that the weight of the lamp is taken by the carrier, and is not left on the hauling-rope, when in the burning position. In designing this new carrier, the firm have had in mind the desirability of obviating the excessive swinging of the lamp in exposed positions during windy weather; and an efficient limiting device can be provided, if necessary. The winch employed with the carriers is the firm's patent self-sustaining type, by which they claim that the risk of failure when raising or lowering the lamp is eliminated.

According to a telegram through Reuter's Agency, Senator Bulnes has introduced a Bill into the Chilian Senate offering a prize of £500,000 to the inventor of a process which will completely extract the nitrates contained in the raw substance called "caliche" and its residues.

We learn from the Hon. Secretary of the Yorkshire Junior Gas Association (Mr. Edward Garsed) that arrangements have been made for the members in a party to visit the premises of Messrs. Nicholson and West, Limited, at Halifax, next Saturday afternoon. There will be special demonstrations of certain drilling tools and other appliances, and, with the exception of burners and fittings, practically everything will be shown, and can be examined at leisure.

VALUE OF A WEIGHT-BALANCE IN COAL-GAS MANUFACTURE.

By C. J. Ramsburg, of Philadelphia (Penn.).

[A Paper read at the Annual Meeting of the American Gas Institute.]

My subject is "The Value of a Weight-Balance in Coal-Gas Manufacture." It perhaps might better have been called some notes on the use of such a balance. It would be an easy task to make a paper on this subject a matter of mere academic interest; but it has been my idea in putting the subject-matter together to avoid this, and to endeavour to bring out the facts in a manner to stimulate the interest of the practical operator.

At the present moment, there are many systems from which to choose if one is contemplating erecting new plant. These may be enumerated as follows: Horizontal stop-end retorts; horizontal through retorts; coke-ovens using "poor" gas for fuel; horizontal chamber ovens, vertical flues, with and without outside producers; horizontal chamber ovens, horizontal flues, with and without outside producers; inclined chamber ovens; inclined retorts; vertical retorts, intermittent (two types); vertical retorts, continuous (two types); vertical retorts, intermittently continuous.

A selection from these systems must be made from many underlying factors; the determination being a result of a composite economic condition embracing them all: (1) Suitability of plant to local ground situation and environment. (2) Investment cost. (3) Elasticity of production. (4) Labour and upkeep cost. (5) Economic use of the coal returning the maximum value in total products.

It is easy to see that the selection of a type of plant must satisfy many conditions. That it develops the ultimate value in products while satisfying certain standards is, of course, an important point, and the one first to be considered. It is to this question of ultimate value that this paper is concerned, though only in so far as the value of a weight-balance may be concerned in reasoning towards that determination.

Coal is, according to Professor Lewes, "the solid degradation product of vegetable decay, together with such of the original bodies as have resisted to a greater extent the actions to which they have been subjected." As such, it is a composite of carbon, hydrogen, oxygen, and nitrogen, with such minerals as have been combined in its structure and are disclosed as ash and as impurities in the gas. The matter which concerns us, however, is that it contains a mixture of hydrocarbons, and as such baffles chemical examination as to little but its ultimate composition. As a mixture of hydrocarbons, standards of value must rest on ultimate analysis, together with proximate analysis—the latter, to be of value, being necessarily conducted under prescribed and standard conditions of method. The examination of coal in this country is made by methods prescribed by the American Chemical Society, as follows:

Volatile Combustible Matter.—Place one gramme of fresh, undried, powdered coal in a platinum crucible, weighing twenty or thirty grammes and having a tightly fitting cover. Heat over the full flame of a bunsen burner for seven minutes. The crucible should be supported on a platinum triangle with the bottom six to eight cm. above the top of the burner. The flame should be fully twenty cm. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon. To find the "volatile combustible matter" subtract the percentage of moisture from the loss found here.

The examination in the laboratory of a well-known American coal will be reported as follows:

Ultimate Analysis.

	Per Cent.
Hydrogen	5·34
Carbon	77·00
Oxygen	7·65
Nitrogen	1·27
Sulphur	1·10
Ash	7·60

Proximate Analysis.

	Per Cent.
Moisture	1·20
Volatile combustible	38·50
Fixed carbon	52·70
Ash	7·60

Let us consider these analyses from the basis of a short ton of coal (2000 lbs.); the same being used as a practical working standard and for reasons of mental grasp.

2000 Lbs. Coal.

Ultimate.

	Pounds.
Hydrogen	106·80
Carbon	1540·00
Oxygen	153·00
Nitrogen	25·40
Sulphur	22·00
Ash	152·00

Proximate.

	Pounds.
Moisture	24
Volatile combustible	770
Fixed carbon	1054
Ash	152

A comparison of these two at once discloses that, by this method of analysis, while there are 1540 lbs. of carbon in the coal ultimately, that by distillation in the method prescribed there are but 1054 lbs. (proportionately) remaining in the crucible, and that 486 lbs. have been driven off in gaseous form. With this same coal, a variation in the method prescribed will give entirely different results, and will show that the relation between the fixed carbon and the ultimate carbon is entirely a matter of method, and that the proximate analysis is only of value when made under standard conditions. In other words, if the coal be heated for a longer time at a lower heat, or for a shorter time at a higher heat, the results will disagree greatly. When we come to actual practice, and compare the results obtained with the proximate analysis, we are more and more convinced that the amount of fixed carbon is a matter of method, and that the amount of carbon remaining in the coke, and the amount driven off in volatile products, is a question of treatment.

Considering again the ultimate analysis, we find that in a ton of this American coal there are 153 lbs. of oxygen. The oxygen appears ultimately in three products—water, carbon monoxide, and carbon dioxide. A small quantity is left in the ash of the coke and in the tar; but they are so small as to be almost negligible. The fact remains, therefore, that in the amount driven off from the coal as volatile combustible there is a considerable amount of water (formed by an association with hydrogen), carbon monoxide, and some carbon dioxide.* In the coal in question this amounts to about 130 lbs. of water and about 20 lbs. of carbon dioxide, but will, of course, vary with the carbon monoxide produced. It will be seen, therefore, that the amount of "volatile combustible" formed, as shown by the proximate analysis—viz., 770 lbs.—must be reduced by the amount of water and carbon dioxide formed, and that the amount of fixed carbon remaining as coke will be a function of the treatment of the coal, and will vary according to the extent to which the breaking-up of the hydrocarbons is carried. It will also be very plain that the amount and quality of the hydrocarbons driven off in the gas will vary accordingly.

In the disassociation of the hydrocarbons and the "cracking" there is a considerable quantity of free carbon formed, which is carried along with the gas. In all forms of carbonizing chambers, where the gas is forced to pass through the coal and coke, this is largely left in the coke. In such forms where the gas passes over the coal and coke in open space of large or small extent, some of this carbon is either deposited in the standpipes and mains or else thrown down in the tar. By referring to the tar-charts in the appendix, this fact will be clearly seen, and will be referred to later in the paper when the tar-charts are discussed. The amount of dissociation and the character of the breaking-down of the hydrocarbons is a function of the temperature the gas attains. Nearly all coal-gas processes indicate the effect of too high temperature on the gas after it is driven from the coal. Nearly all the rich illuminating ingredients of gas are degraded in being heated to a temperature of 1400° Fahr. In connection with this matter of treatment, the subject can best be made tangible and concrete by drawing an analogy to conditions existing in the gasification of hydrocarbons from the carburetting material used in water-gas manufacture.

The electric pyrometer has established the fact that with all oils in ordinary use, whether made up of the fat paraffin hydrocarbons of the Lima and Pennsylvania districts, or the lean naphthenes and asphaltic base compounds of Texas, Russia, and Borneo, or the mixed base oils of Oklahoma, the heats to which the oil is subjected and finally attains in the superheater lies for best efficiency in very narrow limits in the neighbourhood of 1300° Fahr. With any oil, 1400° Fahr. will cause a falling-off in efficiency, and the same is true if the heats be dropped to 1200°. Consider, if you will, two water-gas analyses made with all other conditions the same, the heat being in one instance 1250° and the other 1350°.

Carburetted Water Gas.

	Heat at Base of Superheater. "A" 1250° Fahr. Per Cent.		Heat at Base of Superheater. "B" 1350° Fahr. Per Cent.
Illuminants	13·6	..	12·0
Carbonic oxide	31·2	..	30·7
Hydrogen	34·9	..	34·0
Marsh gas	8·9	..	13·0
Ethane	3·9	..	3·2
Carbon dioxide	3·6	..	3·4
Oxygen	0·2	..	0·2
Nitrogen	3·7	..	3·5

From the oil, therefore, we have:

	Cubic Feet.		Cubic Feet.
Illuminants	136	..	120
Marsh gas	89	..	130
Ethane	39	..	32
	264		282

[No allowance made for hydrogen.]

Or, on an oil-gas basis:

	Per Cent.		Per Cent.
Illuminants	51 5	..	42·6
Marsh gas	33·7	..	46·1
Ethane	14·8	..	11·3

It will thus be seen that a change in heat of 100° makes a material change in the composition of the oil gas. If this be true in a water-gas set, how much more must be the variation in the structure of the hydrocarbons as accomplished in the various methods of treating coal gas, where the heats vary to a greater extent? This effect of dissociation by treatment, and an idea of the extent to which the study of heating effects can be carried, is best illustrated by making weight-balances and following the

* See paper by Porter and Ovitz, "Journal," Vol. CIV., p. 343.

Manchester (N.H.) Weight-Balance.

2000 lbs. coal:

	Per Cent	Lbs.
Moisture	1·3 =	26
Vol. combust.	39·2 =	784
Fixed carb.	51·1 =	1022
Ash	8·4 =	168
Accounted for		2003·74
Less extraneous nitrogen		24·89
		1978·85

		Per Cent.	Feet.	Lbs. Per Foot.	Total Lbs.		Per Cent. of Coal.	
Water	Moisture less water vapour in gas at meter.		26 less 9·17		16·83	123·43	6·17	
	Water of formation.				106·60			
Hypothetical illuminants.	Benzene	1·0 =	111·8	0·2064	23·08		1·15	
	Ethylene	1·2 =	134·0	0·0741	9·03		0·50	
	Propylene	2·2 =	246·0	0·11115	27·34		1·37	18·57
Gas, 11,180 × (0·44 × 0·07658) = 376·01	CO	7·4 =	827·3	0·07407	61·28		3·06	
	H_2	50·7 =	5668·3	0·0053	30·04		1·50	
	CH_4	27·5 =	3074·5	0·04234	130·15	147·90	7 39	some extraneous nitrogen
	C_2H_6	2·0 =	223·6	0·0794	17·75			
	CO_2	2·0 =	223·6	0·11637	26·02		1·30	
	O_2	0·5 =	55·9	0·08463	4·73		0·02	
	N_2	5·5 =	615·0	0·07429	45 69		2·28	

		Per Cent.	Lbs.			
Tar, 14·14 × (1·1443 × 8·3) = 134·30	Up to 100° C. / 100 to 135° C.	1·08 ×	134·3	1·45	127·27	0·07
	135 to 170° C.	0·90 ×	134·3	1·20		0·06
	170 to 200° C.	4·40 ×	134·3	5·90		0·29
	Above 200° C.	88·40 ×	134·3	118·72		5·93
	Free carbon	5·60 ×	134·3	7·52		0·37

Coke 1350·00	Vol. combust.	1·56 ×	1350·0	21·06		1·05
	Fixed carbon	87·12 ×	1350·0	1176·12		58·81
	Ash	11·32 ×	1350·0	152·82		7·64

NH_3 and sulphur 20·00

final products on some particular coal-gas plants that have been the subject of careful study.

In the winter of 1911, it was necessary for me to make a test of a plant of intermittent vertical retorts at Manchester (N.H.)*. Great care was taken to secure accurate results; and it was when preparing the data for a report on this test that I made my first attempt at an ultimate weight-balance. The data (averages) of the test (West Virginia ¾-inch screened coal) were as follows:

Proximate Analysis.

	Per Cent.
Moisture	1·3
Volatile combustible	39·2
Fixed carbon	51·1
Ash	8·4
Sulphur	1·38

Ultimate Analysis.

	Per Cent.
Hydrogen	5·37
Carbon	76·00
Oxygen	7·68
Nitrogen	1·29
Sulphur	1·38
Ash	8·40

Results.

Gas per short ton (corrected) 11,180 cubic feet, sp. gr. ·44.
Candle power 13·47 flat-flame
B.Th.U. 600
Dry tar 14 14 gallons
Specific gravity of tar 1 1413
NH_3 6·17 lbs. per net ton

Weighed coke—
Dry (and hot) 67·5 per cent. (three days' test; all coke weighed).

Analyses of coke—

	Per Cent.
Volatile combustible	1·56
Fixed carbon	87·12
Ash	11·32

Analysis of gas—

	Per Cent.
Illuminants	4·4
Carbonic oxide	7·4
Hydrogen	50·7
Marsh gas	27·5
Ethane	2·0
Carbon dioxide	2·0
Oxygen	0·5
Nitrogen	5·5

Using these data as a basis, the following weight-balance was deduced. It is not claimed that this has not certain factors whose use is somewhat problematical, but it is as near correct as it need be for purposes of reasoning, and is practically correct.

Making the balance in this manner, while based on insufficient data in some places, was nevertheless instructive, and brought out some interesting points.

(1) While the gas obtained contained nearly 51 per cent. of hydrogen, the total amount produced was but 1·5 per cent. of the original coal.

(2) While the proximate analysis of the coal showed 1022 lbs. of fixed carbon, there was accounted for: In coke, 1176 lbs.; in tar, 7·52 lbs.—total, 1183·52 lbs., or a gain of 161·52 lbs. This must have come from dissociation of the volatile combustible.

(3) The volatile combustible from the proximate analysis showed in 2000 lbs. 784 lbs. Of this, we can account for—

	Lbs.
As water of formation	106·06
As gas	376·01
As tar	134·30
As NH_3 and S	20·00

a loss of 147 lbs.

Here, then, was a plant getting almost the best results in total products of which we have knowledge, and the showing was such that from what might be termed the possible volatile—*i.e.*, the volatile combustible—784 lbs. less 123·43 lbs. water or 660·57 lbs., 147 lbs., or nearly 19 per cent., is dissociated into its elements. Of course, no hydrocarbons can be "broken-down" without the formation of some carbon; but this seemed a heavy toll to pay.

This weight-balance at Manchester (N.H.) proved so interesting that it seemed of further interest to make up another one on another kind of plant for purposes of comparison. Fortunately, there had been a paper read before the Institute a few years ago which contained data on this subject—viz., "A Pound of Coal," by Mr. Dudley Lamson—concerning the operation of a plant in Worcester, Mass., of through horizontal retorts of special design and construction.*

The Worcester figures make a weight-balance in the same general plan as Manchester. In this it was necessary to assume that the gas samples given represented average samples of the gas produced during the test, as also specific gravity determinations. The tar sample was that secured from Worcester some little time after the test; but the assumption of correctness is not far enough wrong to cut any figure.

An inspection of this comparison discloses some remarkably interesting data. From a coal not so rich in volatile constituents

For particulars of this installation see "JOURNAL," Vol. CXVI., p. 383.

* See "JOURNAL," Vol. CVIII., p. 392.

Worcester (Mass.) Weight-Balance.

2000 lbs. coal:

	Per Cent.	Lbs.
Moisture	1·3 =	26
Vol. combust.	34·5 =	690
Fixed carbon	57·1 =	1142
Ash	7·1 =	142

Results at Worcester:
Yield per short ton 11,900 cub. ft.; specific gravity ·44.
Coke assumed 1334 lbs. in Mr. Dudley Lamson's paper.

		Per Cent.	Feet.	Lbs. per ft.	Total lbs.		Per Cent. of Coal.
Water	Moisture less water in gas at meter.		26 less 9·17 =		16·83	129·83	6·49
	Water of formation.		565		113·00		
Hypothetical illuminants.	Benzene	1·0 =	119	0·2064	24·57		1·23
	Ethylene	1·2 =	143	0·0741	10·60		0·53
	Propylene	3·0 =	357	0·11115	39·68		1·99
Gas, 11,900 × 0·44 × 0·07658 = 401 lbs.	CO	6·8 =	809	0·07407	59·92		2·99
	H_2	50·2 =	5974	0·0053	31·76		1·58
	CH_4	34·7 =	4129	0·04234	174·80		8 74
	CO_2	1·1 =	131	0·11637	15·24		0·76
	O_2	—	—	—	—		—
	N	1·7 =	202	0·07429	15·24		0·76

Tar, 110 lbs.	0 to 100° C. / 110 to 135° C. / 135 to 170° C.				
	170 to 200° C.	1 23 of 110		1·35	0·02
	Above 200° C.	62·07 of 110		68·28	3·47
	Free carbon	35·80 of 110		39·38	1·99

Coke	Volatile combust.	1·8% × 1334	24·01	1·20
	Fixed carbon	87·8% × 1334	1171·00	58·55
	Ash	10·5% × 1334	140·00	7·00

is produced, by through horizontal retorts, 14·50 lbs. more illuminants, or nearly 24 per cent. more than vertical retorts. There is also an increase of 26·90 lbs. of paraffins, or 18·2 per cent. more. A further inspection shows that this increase of 40·81 lbs. of hydrocarbons has been apparently made from what would have appeared as tar oils. The ton of coal in the verticals formed 127·27 lbs. of tar oils; the horizontals, 69·51 lbs.—a difference of 57·76 lbs. We may therefore deduce the conclusion that the very high results got at Worcester are due to a system which dissociates what would go into tar oils into illuminants and paraffins.

An examination of the Worcester report shows that the amount of coke formed was assumed as being: "Coal *minus* the volatile matter in the coal, *plus* the volatile matter in the coke, equals coke"—*i.e.*, in this instance, 1 − 0·3503 + 0·0176 = 66·7, or on a short-ton basis 2000 − 700·6 + 35·20 = 1334 lbs.

This assumption was doubtless arrived at after some experiment. But it is not true in any other coal-gas plant that I can discover; and practical confirmation is lacking. In order to check this, I requested a larger plant, operating a very similar installation, to make a careful investigation of this phenomena. These results are as follows:

General Comparison between Ultimate Weight-Balance at Worcester with Pennsylvania Coal and Manchester (N.H.) with West Virginia Coal.

	Pounds.		Per Cent.	
	Worcester.	Manchester.	Worcester.	Manchester.
Gas—				
Water	129·83	123·43	6·49	6·17
Illuminants	74·85	60·35	3·75	3·02
CO	59·92	61·28	2·99	3·06
H	31·76	30·04	1·58	1·50
Paraffins	174·80	147·90	8·74	7·39
CO_2	15·24	26·02	0·76	1·30
O_2	..	4·73	..	0·02
N	15·24	45·69	0·76	2·28
Tar—				
0 to 100° C.	..	1·45	..	0·07
100 ,, 135° C.	..	..	..	..
135 ,, 170° C.	..	1·20	..	0·06
170 ,, 200° C.	1·55	5·90	0·07	0·29
Above 200° C.	68·28	118·72	3·42	5·93
Free carbon	39·38	7·52	1·99	0·37
	69·83	127·27	3·49	6·35
Coke—				
Vol. combust.	24·01	21·00	1·20	1·01
Fixed carbon	1,171·00	1,176·00	58·55	58·80
Ash	140·00	152·80	7·00	7·64

Test showing the Fixed Carbon and Ash in Coke from a Charge of 1350 lbs. of Coal. Horizontal Retorts.

	Coal Analysis Per Cent.	Coke Analysis Per Cent.
Moisture	0·97	5·18
Volatile matter	33·76	0·87
Fixed carbon	55·98	81·30
Ash	9·29	12·65
	100·00	100·00
Sulphur	0·99	0·00

Weight of coal charged	1350 lbs.
Length of charge	7 hrs.
Dry coal	1337 lbs.
Dry coke	988 lbs.
Per cent. of dry coke to dry coal	73·9

Coal Content.

	Lbs.		Lbs.
Volatile matter	1350	× 0·3376 =	455·76
Fixed carbon	1350	× 0·5598 =	755·73
Ash	1350	× 0·0929 =	125·42
			1336·91

Coke Content.

	Lbs.		Lbs.
Volatile matter	1042·50	× 0·0087 =	9·07
Fixed carbon	1042·50	× 0·8130 =	847·55
Ash	1042·50	× 0·1265 =	131·87
			988·49

Accounted for in coke—

			Per Cent.
Free carbon	847·55	÷ 755·73 =	112·15
Ash	131·87	÷ 125·42 =	105·14
Total	979·32	÷ 881·15 =	111·14

Test showing the Fixed Carbon and Ash in Coke from a Charge of 1050 lbs. of Coal. Inclined Retorts.

	Coal Analysis Per Cent.	Coke Analysis Per Cent.
Moisture	0·97	0·26
Volatile matter	33·76	2·53
Fixed carbon	55·98	84·50
Ash	9·29	12·71
	100·00	100·00
Sulphur	0·99	0·85

Weight of coal charged	1050 lbs.
Length of charge	6 hrs.
Dry coal charged	1040 lbs.
Dry coke	761 lbs.
Per cent. of dry coke to dry coal	73·1

Coal Content.

	Lbs.		Lbs.
Volatile matter	1050	× 0·3376 =	354·48
Fixed carbon	1050	× 0·5598 =	587·79*
Ash	1050	× 0·0929 =	97·55*

Coke Content.

	Lbs.		Lbs.
Volatile matter	762·99	× 0·0253 =	19·30
Fixed carbon	762·99	× 0·8450 =	644·73*
Ash	762·99	× 0·1271 =	96·97*

Accounted for in coke—

			Per Cent.
Fixed carbon	644·73	÷ 587·79 =	109·68
Ash	96·97	÷ 97·55 =	99·40
Total	741·70	÷ 685·34 =	108·22

This plant secured 73·2 per cent. of coke. On the Worcester basis, they would have secured 66·8 per cent., or a difference of 118 lbs. coke.

The Manchester plant showed an increase in coke yield of 11 per cent. over the crucible determination; the other horizontal plant, 9·45 per cent. Worcester reports no increase whatever. Even if the increase at Worcester were but 3 per cent., the amount of weight added to the weight-balance coke (40·02 lbs.) would mean, to compensate the weight, a lowering of the tar yield by 4 gallons, or a lowering of the specific gravity of the gas from 0·44 to 0·39, which would be a gas of much poorer quality than the report shows. Were the increase the same as in the other horizontal plant, the falling-off in gas and tar would be so great as to make the suggestion untenable.

At Worcester, the fixed carbon in the coal was equal to 1142 lbs. In the coke we find from the analysis 1171 lbs., which would give an increase in the coke of 2·2 per cent. But it is surely drawing the point rather fine to attempt to reason from analyses which do not pretend to quite such exactness or representativeness of identical conditions.

The condition existing at Worcester is so radically different from that which exists in other plants as to suggest careful redetermination for confirmation. The proper way to make this determination is to weigh out carefully a charge of coal, and sample by quartering. Having carbonized the coal as usual, catch the entire amount of coke issuing from the retort and weigh hot. Having allowed this to cool, it should be sampled with great care.

The fact as illustrated in these two weight-balances as to the effect of horizontal and vertical carbonization on the product is well brought out. The horizontal retorts are not like many other such settings, but are specially constructed so as to give very even heating. The retorts are "filled;" and a charging-machine of such a design is used to permit this. There is, nevertheless, a considerable quantity of gas space above the coal. That some of the gas travels through the coal, is doubtless true. But by far the larger amount must travel across the top of the retort and in so doing becomes very highly heated. That this process results in a dissociation of the tar oils into rich permanent gases is a remarkable deduction; but we can come to no other conclusion from the data. On the other hand, the vertical retort requires that a very considerable quantity of the gas shall pass through the coal; and it follows, too, that in this process much of the carbon formed shall be left in the retort as coke.

An unexplained feature of this whole matter is the question of naphthalene. There is a large quantity of naphthalene made and carried forward in the horizontal retort gas; there is almost none in the vertical retort gas. This has always been accepted as indicating that there is a much greater amount of naphthalene made in the horizontal retorts. When we consider the matter further, however, we are impressed by the thought that the reason the naphthalene is not evident in the vertical retort gas is because there is a much greater quantity of tar oils to keep it in solution; and we know from the work done by White and Clary* that these hot tar oils are excellent solvents for naphthalenes. It would be most interesting, if the data were available, to make a comparison in naphthalene produced per ton of coal carbonized by the two processes.

In considering the coke yield, I make no argument with a purpose to prove the Worcester results wrong. It must be remembered that this plant is of special construction; that the method of heating retorts is a most efficient one for even heating; and that the device for charging the retorts is one that ensures an evenly filled retort. On the other hand, the fact is remarkable enough for a most thorough investigation; since this plant has set a standard for coal-gas manufacture which so far outclasses the average plant as to make the latter seem entirely obsolete. No one can read Mr. Lamson's paper and Mr. Dana Barnum's remarks before the New England Gas Association without appreciating that the data in regard to results have been studied with great care for accuracy and clear understanding. But the coke yield is so at variance with all accepted ideas, that one can but wonder if some error has not been made; and therefore I suggest a thorough re-examination.

I think you will agree with me that this setting forth of these weight-balances is interesting, and that its use is likely to be of considerable practical, as well as academic, interest. In connection with a comparison of these two plants on this basis, it is to be regretted that two different coals were used, as the data would be more conclusive if the same coal were used on both plants. The balances in this instance are open to some criticism from

* See "JOURNAL," Vol. XCII., pp. 388, 468.

the standpoint of gas analysis, as the samples were probably not entirely representative of exactly average conditions. I, therefore, wish to take the opportunity of emphasizing the necessity of most careful gas sampling so as to get average samples.

These weight-balances encourage an examination into other systems. A weight-balance was made, in a small way, on the stop-end horizontal nines at Point Breeze, Philadelphia. In this plant, the same coal was in use as at Manchester (N.H.). The balance disclosed some interesting features. This plant was securing the following results:—

Yield	5·10
Candle power	12·80 flat-flame
Specific gravity	·42
Tar	11·60 gals.
Specific gravity	1·20
Coke (weighed hot)	1300 lbs.

A balance from this shows:

	Lbs.
Moisture, less vapour	17
Water of formation	121 (net)
Coke	1300
Tar 11·6 × 9·96 =	116
Gas 10·2 × 0·42 × 76·58 =	328
NH_3 and S	20
Total	1902

The interesting fact about this is that in valuable products this system shows an unaccounted-for amount of 98 lbs. per ton, while securing what would be reckoned in the general gas world as fair results on stop-end retorts. Some little of this 98 lbs. can doubtless be accounted for in the amount of carbonaceous materials removed from the standpipes and hydraulic mains. But the fact remains there is this inefficiency in operation; and it is shown up in the weight-balance. By making a careful test, the exact point of loss could doubtless be discovered.

To confirm this balance, I had a weight-balance made in the same way on a large stop-end plant outside of Philadelphia. This plant was accounting for 1907 lbs. in every ton, and represented results attained by the most careful supervision. That they were equally poor from a balance standpoint only confirms my judgment that the stop-end retort, so constructed as to make it impossible to fill them full, is conceived on entirely wrong principles; and while better results can no doubt be secured, there will always be a large discrepancy and money loss in their operation.

Last year, before the Institute, we were presented with figures on the Providence Dessau verticals.* While these data are not complete enough, they are of sufficient amount to be able to make a primary weight-balance which is interesting. I will take for the balance the results given in July, 1911, as representing the highest gas yield from 2000 lbs. of coal.

	Lbs.
Coke	1400
Gas (assumed, specific gravity not given) 0·42 × 76·58 × 10,640	342
Tar 11 × 112 × 8·3	102
Assumed same as Worcester—moisture, less vapour, *plus* water of formation	139
NH_3 and S	20
Total	2003

This, in turn, shows an accounting for all the material charged and its accuracy is within the limits, considering that so many assumptions have to be made. But the fact remains that in this case, as at Manchester, there was a considerable amount of hydrocarbons in the original coal which are found in the coke as carbon. From the fact that the coke is given as exactly 70 per cent. in all the tests shown, I am led to believe that it was not determined in each instance. I think that if it were, and were accurate, careful analyses made of average samples, much useful information would be disclosed in making a thorough weight-balance.

I believe that I have said enough to show the value of a weight-balance. I believe the weight-balance can be made a useful adjunct to all test-cuts of new plants, and should advise that one be made in this connection. The coke produced from a given amount of coal should be weighed from time to time, hot, and an analysis made of coal and coke; tar samples should be collected, with the quantity determinations; last, but not least, careful gas samples representing average productions should be secured. The water can be easily calculated or measured. The whole data can be digested into a balance by weight that will go a long way in explaining causes of success or failure.

The weight-balance can also be made use of in sizing-up guarantees of results to be produced made by active selling agents. I have had opportunity on several occasions to show that such guarantees, apparently made in good faith, totalled-up in weight to 100 lbs. per short ton more was then put in. On old plants also the balance can be well made use of to disclose failures and their cause, and perhaps remedies.

The weight-balance on a coal-gas setting can also be carried into another field, the importance of which can scarcely be overestimated, and is almost universally under-estimated—viz., the amount of fuel used to effect the carbonization of the coal. The chief cause of the lack of interest in this important factor of uneconomical operation is the difficulty of tracing the efficiency of the fuel and the amount used in any practical way. Generally speaking, all bench-fuel results are secured by difference, and therefore bear the omissions and commissions of all other features of coal and coke handling. It is worth careful analysis, however, and when it is realized that there are plants operating with 250 lbs. of fuel per ton of coal carbonized and others on 350 lbs., and that this poor engineering, or poor operation, is subjecting the plant to an additional cost equal to the entire retort-house labour-cost, and sufficient to pay the interest on an additional outlay of many dollars per ton of coal carbonized, then the use of the weight-balance as a source of information may be considered important. Euchène gives the distribution of the heat from the bench fuel as follows:

Balance by Weight (after Euchène) on Bench of Eights Stop-End Horizontal Retorts.

Make per mouthpiece	9710 c. ft.
Yield per pound	4·91
Candle power, flat-flame	13·50
Waste gases	1112° Fahr.
CO_2	18·40
Furnace fuel per 2000 lbs. carbonized	296 lbs.

Distribution of coke energy, by pounds of furnace fuel:

	Lbs. per Ton.
By sensible heat of flue gases	96·4
,, ,, ,, gaseous vapours	52·8
Sensible heat of coke	70·8
By radiation	79·2
By formation of volatile compounds	5 7
By decomposition of coal	74·6
By sensible heat of clinker	3·1
Total	383·0
By credit due to heat of formation of volatile compounds	87·0
	296·0

This 296 lbs. per short ton represents no better than average practice, and not nearly so good as many plants are able to effect by changes in design and methods of operation.

Let us consider in what points of this balance economies and wastes may occur. Eliminate at once the following:

	Lbs. per Ton.
Sensible heat of flue gases	96·4
,, ,, ,, gaseous vapours	52·8
,, ,, ,, coke	70·8
Formation of volatile compounds	5·7
Decomposition of coal	74·6
Sensible heat of clinker	3·1
Total	303·4
Less credit of	87·0
Quantity necessary for carbonization under conditions stipulated, without radiation	216·4

The radiation loss of 79·2 lbs. is, of course, largely necessary, but can undoubtedly be improved upon, and is accomplished in some plants. The fact is, therefore, patent that no lower bench fuel per ton of coal carbonized can be effected unless, first, the sensible heat of the escaping flue gases is lowered (and recovered) below the 1112° Fahr. named here This may be accomplished by more effective recuperation or regeneration. It may also be effected by a lowering somewhat of the quantity and specific heat of the escaping flue gases. For example, by the use of carbon dioxide, instead of steam as an endothermic, the quantity of gases for the same carbon dioxide content will be exactly the same, except that there will be an additional heat carrier of 0·4 lb. of steam per lb. of combustible. This would subtract from the furnace fuel—*i.e.*, carbon dioxide endothermic in place of steam, 10·5 lbs. carbon, or about 13 lbs. of coke per ton of coal carbonized.

The heat loss by gaseous vapours is a necessary loss, varying some little with various systems of operation. The sensible heat of coke (net coke) cannot be recovered, except in such systems as cool the coke by the use of the secondary air by special design. This gives more heat to be utilized in the spent gases, which might, on the other hand, be easily recovered as useful energy in the form of steam. The three items, "by formation of volatile compounds," "decomposition of coal," and "sensible heat of clinker," need no comment, as they are necessary losses.

The question arises then, In what are the losses in many plants over and above these figures? The answer must be in either escaping latent heat at the stack or unconsumed carbon in the ash. The last named is very easily ascertained by careful examination into quantity and quality of the material withdrawn from under the fire. It may be noted, in passing, that this is a frequent source of large losses.

In regard to the losses at the stack, this is not so easy a problem, for it must be borne in mind that casual sampling of flue gases is apt to be very misleading, inasmuch as natural draught is dependent on fire conditions, and that in plants with small grate area and low fusing ash coals, the quantity of primary air varies largely between cleanings and slicing of fires. This loss of 96·4 lbs. of coke per ton at the stack involves a composition of the gases of 18·4 per cent. carbon dioxide. Each per cent. of carbon monoxide at the stack represents an unnecessary loss of 12 lbs. of fuel per ton carbonized. Each per cent. oxygen in the flue gases represents an increase in volume of 5 per cent. and roughly at the 1112° Fahr. means a loss of 3·5 lbs. of coke.

The chief source of loss in bench fuel (and as I have said before this is a loss unappreciated in most plants) would seem to be due to losses at the stack through insufficient or excess secondary air. That this loss may be due to both in the same bench at

* See "JOURNAL," Vol. CXVI., p. 383.

different periods of the clinkering cycle is not improbable. Its remedy lies in better design of furnaces and grates.

Another weight-balance which can be made a practical balance is on ammonia. There are two forms of ammonia to be checked, fixed ammonia and gaseous ammonia. It is with the latter that I wish to deal chiefly in a brief manner. The gas issuing from the hydraulic main can be readily sampled and tested for ammonia content with the hydrogen sulphide burette. By the use of a solution of sulphuric acid of standard strength, the grains of ammonia per 100 cubic feet can be readily ascertained. By measuring the fixed ammonia from the quantity and quality of the liquor coming from the hydraulic main, and adding to this the amount of ammonia in the gas per ton of coal carbonized, the ammonia made per ton can be readily ascertained. Comparing this with the amount recovered for sale will give a comparison, of profit and interest.

[As an appendix to the paper, the author gave a number of tables showing the distillation and dephlegmation of tars secured from home and abroad from nearly all the present systems of carbonization. He explains that he presented them as bearing somewhat upon the points in regard to fixed carbon which he had made in a comparison of weight-balances at Worcester and Manchester.]

SMITH'S RECORDING GAS CALORIMETER.

When noticing, in the last number of the "JOURNAL" (p. 964), the equipment of the Fuel-Testing Station of the Canadian Department of Mines, it was mentioned that among the instruments employed in connection with the tests of peat forming the subject of the report by Mr. B. F. Haanel, from which some extracts were given, was one of Smith's recording gas calorimeters.

Fig. 1.—Smith's Recording Gas Calorimeter.

The instrument—shown in fig. 1—which is manufactured at the Lexington (Ohio) Instrument Works, constituted, according to Mr. Haanel, a valuable adjunct to the equipment, "since the change in the heating value of the gas is perceived at once, and can be rectified by the producer attendant." The calorimeter, which does not appear to have been described in any of the technical publications, is shown in the accompanying illustration;

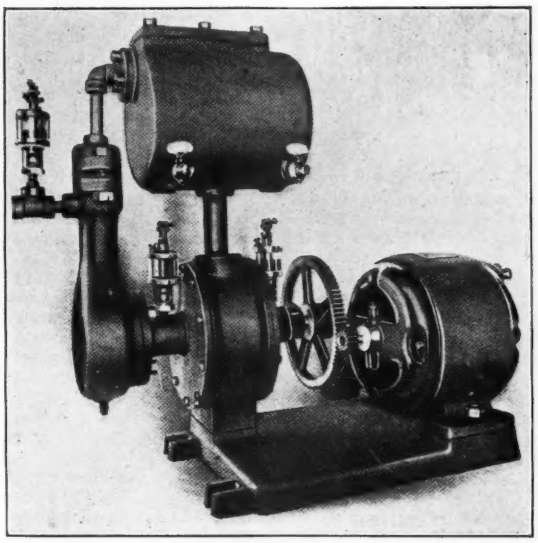


Fig. 2.—Air and Gas Pumps, with Motor for Smith's Gas Calorimeter.

and a good idea of its working may be obtained from the following particulars.

The sampling pump (fig. 2) is really nothing more than a power-driven meter, which delivers a certain definite portion of gas to be tested, and also a definite measured supply of air for the calorimeter. The air and gas from the sampling pump are piped separately to the calorimeter proper, and the gas burnt in this measured supply of air. The difference in temperature between the ingoing air and the outgoing products of combustion is a direct measure of the calorific value of the gas. All readings are automatically corrected to give the net calorific value of the gas (measured moist), at 60° Fahr. and 30 inches of mercury. The apparatus is fitted with an electrical ignition appliance. The button shown on the side of the calorimeter near the bottom constitutes the sparking connection for igniting the gas.

With regard to correction to temperature and pressure standards, the instrument makes automatic correction only for the variations in gas volume due to temperature and pressure. Whatever water vapour may be in the gas at the time of its passing to the calorimeter is treated, for the purpose of correction, exactly as though it were so much nitrogen. If the gas is dried by chemical means before passing to the instrument, the determinations would then be for dry gas at 60° Fahr. and 30 inches of mercury.

It is not necessary to dry either the gas or the air passing to the calorimeter, or to supply them saturated, unless it is desired that the determinations should be on the basis of dry gas, in which case the gas sample going to the instrument should be chemically dried before passing the sampling pump. It is not necessary to pay any attention whatever to the condition of air with regard to moisture content. This may sound rather startling; but a brief consideration will show that the error introduced by the presence of water vapour in the air supply is very small indeed. It is quite true that the specific heat of water vapour is practically double that of air under the same conditions. However, it should be remembered at the same time that this specific heat is calculated on the basis of weight; and while the specific heat of water vapour is practically double that of air, its specific gravity is only approximately one-half that of air. To reduce the matter to concrete figures, if we assume extreme cases, taking absolutely dry air at 100° Fahr. and comparing its total specific heat with that of completely saturated air at the same temperature, it will be found that the difference, even under these extreme conditions, amounts to only a small fraction of 1 per cent. Accordingly, for all practical purposes, this has been assumed to be negligible; and in all the experiments made by the makers, they say they have never been able to detect any appreciable difference in the readings of the instrument which could be traceable to the condition of air with respect to moisture content.

The sampling apparatus furnished with the equipment is designed to draw the gas sample from mains that are under the ordinary suction required for operating a suction gas-producer. If this suction were extremely high—that is to say, from 14 to 16 inches of water—one would expect that this would make a slight variation in the readings of the instrument, since for perfectly correct readings the gas and air should both be taken at the same pressure. However, a brief consideration will make it clear that a small variation would not cause any appreciable difference in the accuracy of the apparatus.

Any gas that is fit to supply a gas-engine can be used through the apparatus without further purification. The gas-pump is supplied with continuous lubrication, which protects the working parts from any special interference from the slight tar vapour present in gas from bituminous coal as it is ordinarily supplied to an engine after mechanical scrubbing. In any event, all that

would be required would be an occasional cleaning of the gas-pump, which is a comparatively simple operation.

The established ratio between gas and air in the instrument is 1 to 29. This gives a total volume of products of combustion of 30 to 1, as compared with the gas supplied, which approximates very closely to a rise in the temperature of the products of combustion of 1° C. for each B.Th.U. per cubic foot of standard gas. The large air excess, together with the fact that the specific heat of nearly all the products of combustion from the burning of the small quantity of gas are the same as that of air, renders the instrument practically immune from variation in readings due to variation in the actual composition of the gas. Of course, there is a slight error; but if the extreme conditions that are likely to be met with in any sample of producer gas that is capable of combustion be assumed, and a calculation made of the amount of variation that would result from the extreme change in composition of these elements, it will be seen how negligible this factor is. The large excess of air which ensures that, for all practical purposes, the specific heat of the discharging products of combustion will be that of air, is relied upon to reduce liability to error.

The thermocouple here employed is not, strictly speaking, one in the electrical sense of the term, but is rather a mechanical couple consisting of a steel tube, exposed on the outside to the atmospheric air and on the inside to the supply of atmospheric air (delivered by the sampling pump), which constitutes the zero member of the pair, and a thin steel tape, which is exposed throughout its length to the outgoing products of combustion, and the length of which, as compared with the length of the zero member of the pair, is taken as a measure of the temperature of the outgoing gas. The parts taken together constitute a means of indicating the difference in temperature between the ingoing atmospheric air and the outgoing products of combustion. This difference in length is carried through a simple multiplying gear to the needle holding the recording pen. The tape which constitutes the hot member of the couple is quite thin, so as to make it respond promptly to any change in temperature—thus making the apparatus highly sensitive to variation in the quality of gas.

The manner in which this instrument gives correct readings is quite obvious. The corrections are to compensate for the change in the heating value of the gas, due to volumetric variations induced by change of temperature and pressure. It is perfectly clear that when the heat-absorbing medium is an elastic gas, and when this is handled through the sampling pump under the same conditions of pressure and temperature as air, any condition affecting the calorific intensity of the gas metered would affect the heat-absorbing capacity of air in exactly the same manner. Thus, under high temperature conditions, the gas would be expanded, and would have lower calorific value per unit volume. But the air supplied would be under the same conditions, and would be expanded likewise, with a corresponding loss of heat-absorbing capacity. Consequently, a definite volumetric ratio being established, and the instrument being calibrated under standard conditions, no corrections whatever would be required; for deviation in pressure or temperature difference per actual B.Th.U. would be exactly the same in any case. This has been borne out in an experimental way to the entire satisfaction of the makers, though the correction is not absolutely perfect on extremely wide ranges. For example, a change in altitude from sea level to 7000 feet will make an actual variation of about 1 per cent. in the readings of the apparatus. It can be seen, however, that the error that would be introduced from small variations, and particularly from the variations that would occur in any one plant from day to day, would be entirely negligible.

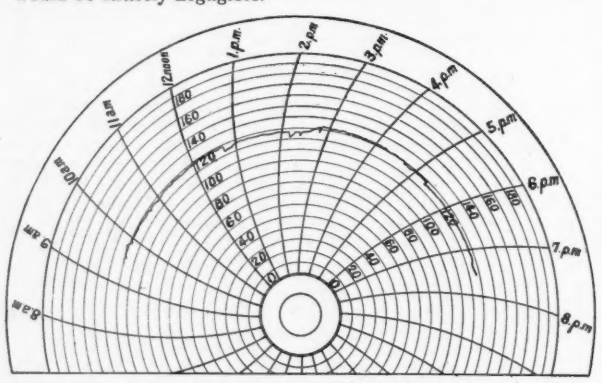


Fig. 3.—Sample Record from Smith's Gas Calorimeter.

The instrument is designed to operate on gas up to 200 B.Th.U. per cubic foot, which would include blast-furnace and producer gas. The lower limit is somewhere in the neighbourhood of 60 B.Th.U. per cubic foot. The cards are calibrated down to zero; and readings are shown as long as the instrument can be kept lighted. The sampling pump and calorimeter were set up in the engine-room close to the engine. A length of about 6 feet of ¼-inch pipe carries the gas from the engine gas-receiver to the pump; and about 6 feet of similar pipe and a like length of ⅛-inch pipe carry the gas and air respectively from the pump to the calorimeter.

When Mr. Haanel prepared his report, no tests had been made to standardize the calorimeter by means of the Junkers or Boys instruments; but he says that comparison of its readings with the calorific values of the gas calculated from the analyses of samples taken at different times, shows the former are almost invariably the higher—the difference usually ranging from 5 to 10 B.Th.U. per cubic foot. The chief value of the instrument for the purpose of the investigations so far carried out lay in the prompt indication it gave of the effect of any change made in the working of the producer upon the calorific value of the gas, and the record it gave of the uniformity or otherwise of the gas while the conditions of working remained unchanged. The frequent checking of the instrument by means of analyses of samples of gas showed that its relative readings were at least approximately correct. The absolute values were, for the purpose in view, of very little importance. The specimen record shown (fig. 3) gives an indication of the sensibility of the instrument.

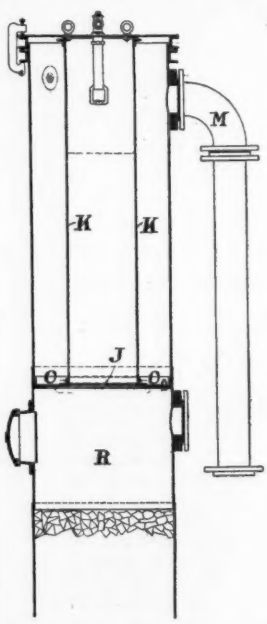
SEPARATING TAR FOG FROM PRODUCER GAS.

Mr. Haanel's Improved Separator.

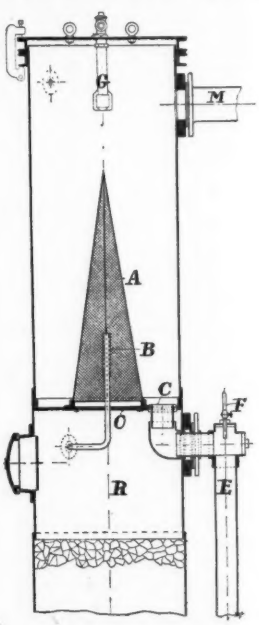
In the portion of Mr. Haanel's report on utilizing peat fuel for the production of power, which was given in the "JOURNAL" last week (p. 964), some reference was made to the improvement effected by Messrs. Körting in the producer plant with the object of eliminating the tendency to the formation of tar, and so obviating the frequent cleaning of the gas-engine. An alteration was made in the coke-scrubber; but it did not altogether effect the desired result. Experiments were therefore carried out to endeavour to discover a method of effectively separating the tar fog; and the following is the account given of them in the report.

To determine under what conditions the tar fog would condense from the gas, and how these conditions could be applied in a simple but effective manner to a cleaning system, with special reference to the one already in place, experiments were undertaken with a view to investigate the effect on the matter held in suspension by the gas of varying the velocity of the gas by means of different shaped pipes, &c.

When a gas heavily charged with the tar fog is drawn from a larger to a smaller chamber—for example, through a glass tube of about 1 inch diameter at the inlet end drawn down to a small fraction of an inch at the outlet end—the velocity is very greatly increased; but if the gas is then expanded into a second chamber of like diameter, similar to that of the gas-inlet end, the following phenomenon may be observed: In the contracted neck between the two expanded chambers the tar fog is seen to condense on the glass walls as a brownish-black grease. This then forms into small globules or pellets, which are shot out with very considerable force into the expansion chamber. This phenomenon may be due to the great resistance set up by the rapidly flowing gas against



Section of Korting's Improved Wet Coke Scrubber.



Haanel's Newly-Devised Tar Separator.

the glass surface, causing the particles to lose their velocity and thus accumulate; or it may possibly be due to the crowding together of the stream lines affecting the deposition of the tar fog on the walls of the channel, or to a combination of the two.

These experiments showed that the tar fog could be separated from the gas in this manner; but the high suctions necessary to draw the gas through the small tubing, and the tendency to the

increased suction due to clogging of the pipes or tubes, renders such a method impracticable. As a result of the experiments, a separator was devised by Mr. Haanel which, as mentioned last week, has proved to be very efficient, is entirely dependable, and can operate for any period without clogging, and therefore without producing increase of the suction. The appliance is shown in the accompanying diagram side by side with the Körting coke-scrubber as improved.

The lower part of the scrubber has not been altered. The cylinder K of the left-hand diagram and the perforated plate J have been removed, and in their place has been substituted the wire-mesh cone A on the other diagram. At C, an overflow has been provided for the purpose of carrying away the solid matter separated from the gas on the outside of the cone, and washed off by the water-spray G. A water-spray B serves the combined function of washing the interior surface of the cone and of cooling the gas. At F, a water-jet has been provided for sluicing out the overflow-pipe E, whenever this shows a tendency to clog. This, however, it has never been necessary to use—the overflow-pipe remaining absolutely clean. The water-spray G, which in the old system was supplied with cold water only, is now connected by a two-way cock to the return cooling water from the gas-engine. Whenever the suction in the chamber containing the wire-mesh cone begins to rise, the cold water at G is shut off and the hot water turned on. By this means the suction, whatever it may be, is brought to the normal in about a minute. The cone is made of 40-mesh brass wire screen.

Operation of the Improved Tar Separator.

The gas passes through wet coke into the chamber R as before. From this chamber the expanded and cooled gas is drawn through the opening O, through the cone screen, and passes out at M. In passing through the screen, some of the particles of the tar fog still carried by the gas impinge against the metallic surface of the cone, aggregate into comparatively large drops, and are washed off by the continuous spray B—dropping into the chamber R, through the wet coke, down to the water-seal. The particles escaping contact with the metallic surface of the cone, in passing through the fine meshes, are crowded together, and are thus caused to coalesce—forming larger drops, which either adhere to the outside surface of the cone or else drop to the bottom, when the continuous cold water spray G washes this tarry matter to the overflow at C.

It will thus be seen that the action of the cone screen in eliminating the tar fog is twofold: (1) in producing coalescence of the fog particles by impact with the solid parts of the screen; (2) in causing coalescence of the fog particles by crowding together the stream lines as the gas passes through the fine meshes of the screen, and retarding the particles by friction with the internal surface of the meshes. When the suction shows any tendency to increase, the cold water at G is turned off, and the hot water turned on, which in a short time thoroughly cleanses the cone at an expenditure of a very small amount of water.

After leaving this cleaning system, the gas is sufficiently free from deleterious material to allow of its being used in the gas-engine without any trouble whatever. Moreover, the cleanliness of the gas is not dependent upon the perfect operation of the producer itself, but permits of a large variation in the conditions governing its operation. For example, the cleanliness of the gas—its freedom from tarry matter as it leaves the producer—depends, in the first place, on the moisture content of the peat burned; secondly, to some extent, on its quality; and, thirdly, quite considerably on the amount of air admitted to the two zones. Close and careful regulation is, therefore, not so essential to the cleanliness of the gas leaving the cleaning system as it was with the former construction, though obviously an advantage, in so far as the waste of tarry matter is reduced.

Recent Achievements of the Chemical Industry.

In the course of a lecture by Dr. Carl Duisberg, Director-General of the Farbenfabriken of Elberfeld Company, before the Eighth International Congress of Applied Chemistry, he remarked that the manufacture of bye-products, in the natural course of events, accompanies the direct production of energy from fuel. The latest method of the utilization of peat—the Frank and Caro process—is in operation in Schweger Moor, near Osnabruck. There peat gas is produced and used and ammonia obtained as a residual product. Nearly 88,400 to 91,800 cubic feet of gas were produced from 1000 kilos. (2200 lbs.) of air-dried peat with 45 to 70 per cent. of moisture. This gas represents energy equal to 1000 H.P.-hours, after deducting the heat and power used for the operation of the gas-works. In addition, 35 kilos. of ammonium sulphate were produced. Dr. Duisberg added that a new way of manufacturing sulphuric acid, together with ammonia, from the gases which are produced by the dry distillation of coal is looming above the horizon. Herr Burkheiser is seeking, with the aid of specially prepared wet iron compounds, to bind the sulphur, simultaneously absorbing cyanogen, and to convert the ammonium sulphite thus produced into ammonium sulphate by oxidation with atmospheric air. In competition with him, Walter Feld is endeavouring to recover sulphur directly as ammonium sulphate by a series of interacting reactions in which thiosulphates play an important part.

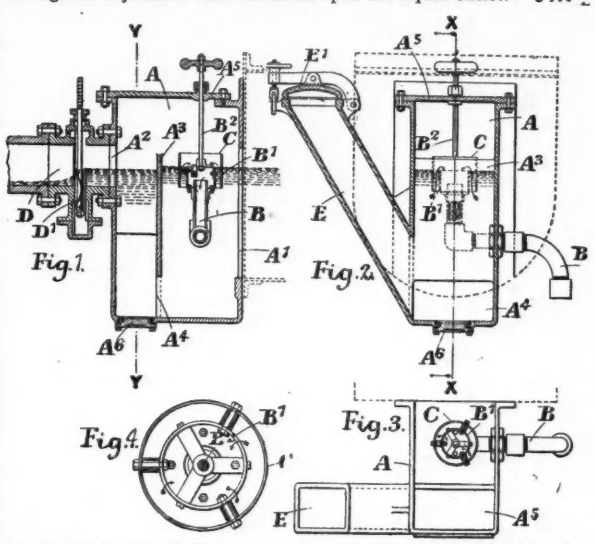
REGISTER OF PATENTS.

Hydraulic Mains Plant.

Clarke, H., of London Wall Buildings, E.C., and Campbell, J. A., of Ilford, Essex.

No. 14,065; June 13, 1911. Redated Dec. 12, 1911.

This invention relates to means for the removal of tar and liquor from the hydraulic mains of gas plant—"whereby the tar and the liquor may be effectively separated the one from the other and discharged by different outlets, of the kind in which the tar is separated from the ammoniacal liquor, by reason of the difference of specific gravity, by a dividing apron extending across the take-off chamber and having an aperture at the lower end, and the liquor is drawn off through an adjustable valve mounted upon the liquor outlet."



Clarke and Campbell's Tar and Liquor Discharge from Hydraulic Mains.

Fig. 1 is a sectional elevation on the line XX of fig. 2, and viewed in the direction of the arrows. Fig. 2 is a sectional elevation taken at right angles to fig. 1 on the line YY. Fig. 3 is a plan; the cover-plate of the take-off chamber being removed. Fig. 4 is an enlarged view of the adjustable valve and screen for the removal of the liquor.

There is provided a rectangular take-off casing A at the lower end of the hydraulic main, adapted to project somewhat below it, and having at the one side a large aperture A^1, by which direct and free communication with the hydraulic main is established, and at the opposite side a smaller aperture A^2, at some distance from the bottom, by which the tar may pass away to the casing of the weir-valve. Across the middle of the casing is a transverse partition A^3, forming two compartments communicating at the lower end by an aperture A^4, by which the tar is separated from the ammoniacal liquor by reason of the difference in their specific gravities.

The outlet pipe B for the liquor is led into the compartment of the casing A, from which the liquor is to be removed, and is upwardly turned so that the end is below the level it is desired to maintain in the hydraulic main. The end is screw-threaded to receive a sleeve or cup valve B^1, over the upper edge of which the liquor is discharged; and the valve is controlled by a spindle B^2 secured by a spider, and passing upwardly through a stuffing-box and gland provided on the cover-plate A^5 of the casing, and having a hand-wheel upon the extremity by which the position of the valve may be adjusted to vary the level at which the liquor is removed.

Around the sleeve or cup valve B^1 there is disposed a screen or sleeve C secured concentrically to the sleeve or cup valve so as to form an annular space between, by which the liquor may pass upwardly to the upper edge of the valve. The screen C serves to prevent the removal of the light oils, which float on the surface of the liquor, through the liquor discharge. It is conveniently provided of such length that its upper end is always maintained slightly above the upper end of the partition A^3, which divides the device into two compartments and separates the tar outlet A^2 from the liquor outlet pipe B. By this arrangement, the light oils flow over the upper end of the partition and are removed along with the tar.

Adjacent the aperture by which the tar escapes there is provided a casing D containing a weir-valve D^1, over which the tar is discharged.

The take-off casing is provided at the lower end with a cleaning-out door A^6, while at one side of the casing in the wall of the outer compartment is an aperture leading to an inclined cleaning-out chamber E closed at the upper end by a sealing cover E^1 retained in position by a locking lever operated by a screw staple and hand-wheel.

The patentees close their specification by stating: There is no novelty in the provision, in apparatus of the kind to which the invention relates, of a vertically adjustable cap valve upon the liquor outlet with a surrounding screen to prevent the passage of the light oils. They are also aware that it has been proposed to provide a weir-valve to control the discharge of both the tar and the liquor from the hydraulic main; the valve casing being provided on the one side with a trough to project into the hydraulic main, partitioned to form two compartments—one adapted to receive the liquor through a suitable orifice and the other to receive the tar by a downwardly depending pipe, the liquor and tar so separated being discharged by the weir-valve through separate outlets.

Using Coal Tar Extract for the Preparation of Paints.

PETERSEN, J., of Vedbygaard, Denmark.

No. 10,958; May 8, 1912.

This invention refers to the preparation of paints, impregnating compositions, &c., from coal tar extract obtained by known methods.

It has already been proposed, the patentee points out, to mix coal tar or like liquid hydrocarbons with any suitable vegetable or mineral oil, thereby causing the tar to separate into a liquid and a heavier portion. It is this liquid portion that forms the coal tar extract referred to in the present invention, serving for the preparation of paints and impregnating compositions particularly suitable for painting ships and impregnating sails, ropes, wood, &c.

In carrying out the invention, 1 litre of coal tar is mixed slowly while gradually stirring with 3 litres of petroleum—only a very small quantity of the latter being first added, and then little by little until the required quantity is admixed. At the moment when this is accomplished, the composition begins a kind of chemical boiling or ebullition—a reaction taking place; and it is segregated into an upper and a lower layer or stratum. The upper one is a thin, oleaginous liquid, which has a light yellow colour, while the lower one is a sediment consisting of a dough-like or tar-like substance.

If it is desired to prepare ship's paint from the upper stratum, consisting of petroleum mixed with coal-extract, about 1 litre of the mixture is mixed with about 4 litres of petroleum and 1 litre of ordinary varnish. These ingredients are carefully mixed by stirring, until there again occurs a kind of boiling or ebullition, which in this instance, however, does not have a segregating action but a uniting effect on the substances, so that their union becomes permanent. To the liquid thus formed should be admixed a suitable quantity of ochre and, eventually, some other pigment. The paint, thus prepared, saturates wood and impregnates it, and protects both wood and iron against the effects of water and the vegetable and animal parasites contained in it. Neither is the paint liable to peel off, since its oleaginous or fatty matter does not evaporate.

If it is desired to use this coal-tar extract for impregnating sails, ropes, &c., a mixture of about the following proportions is used: 5 kgr. yellow ochre, 1 kgr. red ochre (Indian red), 10 litres petroleum, 1 litre oil of turpentine, and ½ litre coal-tar extract. First the liquid parts are mixed, and then the pigments are admixed. But it has been found that this mixture does not answer its purpose until the coal-tar extract is added.

If wood is to be impregnated, no pigments are used, but only about 1 litre of wood-tar, 4 litres of petroleum, and 1 litre of coal-tar extract —the parts being mixed by stirring. Even in this case, the coal-tar extract has proved to be the essential ingredient for the good and enduring protection of the wood. The same mixture may also be used for the treatment of iron and other metal which is to lie in water; and it has been found that iron treated with this mixture will not rust even in stagnant fresh water.

Purification of Illuminating and Coke-Oven Gas.

DAVIDSON, W. B., of Birmingham.

No. 23,696; Oct. 26, 1911. Redated, April 25, 1912.

The patentee, in his specification, says: Processes for the purification of illuminating and coke-oven gas are known in which ammoniacal liquor is led to a still, into which steam is blown at the bottom of a column of liquid-sealed trays, to heat the liquor and thus distil off from it the acid gases, carbon dioxide and sulphuretted hydrogen, and the ammonia in gaseous form; the acid gases being separated from the gaseous ammonia by leading them off from the still at a higher level than that at which the ammonia is removed.

The present invention relates to such a process, and consists in graduating both the pressure and temperature within the still; the pressure being regulated in such a manner that a comparatively high pressure is obtained in the portion of the still from which the ammonia is collected, so that the gaseous ammonia may be recovered with a high degree of purity. The working pressures are so arranged that the gaseous ammonia when leaving the still may be passed through absorbers to remove any traces of the carbon dioxide and sulphuretted hydrogen remaining therein, and still have sufficient pressure to exercise a jet action within the condensers or scrubbers, so that the gaseous ammonia, or a portion of it, may be thoroughly mixed with the gas to be purified. From these washers, scrubbers, or condensers the ammoniacal liquor, with the acid gases present, is collected and returned to the still, where the practically pure ammonia distilled off in gaseous form and under suitable pressure is again collected and returned to the scrubbers. By this means, a continuously working purifying process is said to be obtained, as the still has not to be stopped for the removal of the solution, as in many cases has hitherto been necessary, owing to the ammonia remaining in the solution when the acid gases are distilled off.

By the graduation of the pressures and temperatures within the still, the patentee claims to be able to recover the ammonia in a very high state of purity, as the gaseous ammonia recovered may contain as much as 95 per cent. of pure ammonia. The feature of taking off the ammonia in a gaseous state and under comparatively high pressure has a further advantage, as by this means the gaseous ammonia, even after passing washers or scrubbers to remove any traces of carbon dioxide or sulphuretted hydrogen, may be injected into the scrubbers under favourable conditions for mixture with the illuminating gas to be purified, "so as to exercise a more powerful purifying action to remove the acid gases from the illuminating gas to be purified." The high and graduated pressures within the still obviate the necessity of providing a steam-jet to draw the ammonia from the still, and renders it possible to obtain the high degree of purity of the ammonia given above. It is also more convenient to have the acid gases coming off under pressure, as it avoids pumping to circulate them in their later treatment.

The still for purifying the ammoniacal liquor—that is, separating the ammonia from the sulphuretted hydrogen and carbon dioxide—may be of ordinary columnar pattern, or it may be composed of simple chambers connected to each other by suitable piping. Fig. 1 shows in elevation such a still. Fig. 2 is a sectional detail of some of the layers of the column. Fig. 3 is a plan of one of the trays. Fig. 4 is an enlarged view of one of the hoods of the steam leads.

The ammoniacal liquor is fed in at A (at the end remote from the heating means). The preferred form of heating is by the introduction of steam at the bottom, as at B, or the part where the liquor which has been deprived of its ammonia leaves the still at C. The steam rises up the still through pipes D in the trays E, being caused to break up into a number of jets by means of hoods F, over the pipes D, with serrated lower edges G. The liquor flows from tray to tray down the still, in opposition to the steam, through overflow pipes H. At the top of the still an outlet I is arranged for the sulphuretted hydrogen and carbon dioxide, and a cock J assists in the regulation of the pressure in the still. The pressure is so graduated that the highest is obtained where the steam is applied at the bottom and the lowest at the top where the impure gases are liberated; the pressure in and about the middle chamber where the ammonia is given off at K being intermediate between the two. What is regarded as near the minimum pressures within the still for the satisfactory working of the process are approximately 5 lbs. per square inch at the portion where the steam is applied, approximately 4 lbs. at the portion where the ammonia is removed from the still, and 3 lbs. at the portion where the acid gases are led off from the still. Higher pressures than these work more satisfactorily, as they give more scope for graduation, and therefore higher efficiency of the process; but the pressures must be approximately in the ratio named. A pressure of 25 lbs. per square inch at the portion of the still where steam is applied, and similarly graduated above, is found to be very satisfactory; but higher pressures may be used if within the capacity of the still. The pressures can be regulated during working by adjusting cocks on the ammonia outlet and the outlet for acid gases and a reducing valve on the steam inlet B. Pressure gauges are provided adjacent to the steam inlet portion, the ammonia outlet, and the outlet for the acid gases.

The temperature is likewise graduated up the still, as the steam heating is effected at the base, and the temperature of the liquor fed in at the top is preferably regulated to a suitable degree for working conditions. It is found that about blood heat (or a little above) is a satis-

Fig. 1.

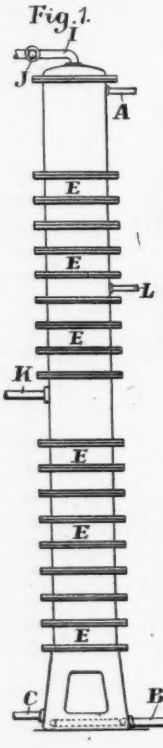


Fig. 2.

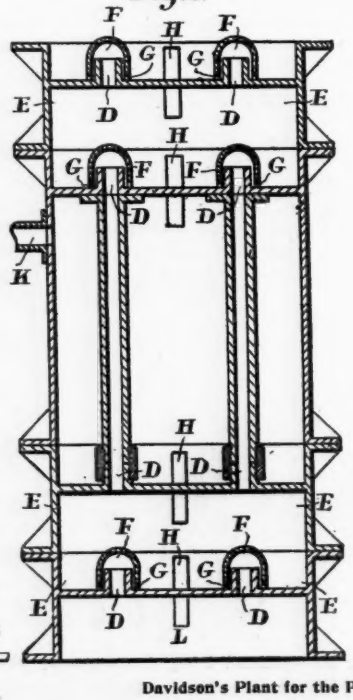


Fig. 3.

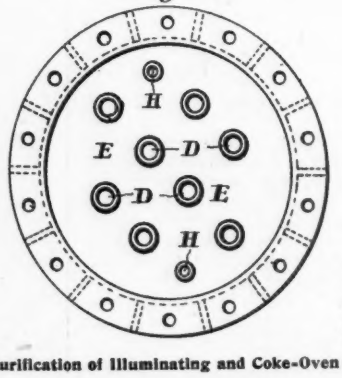
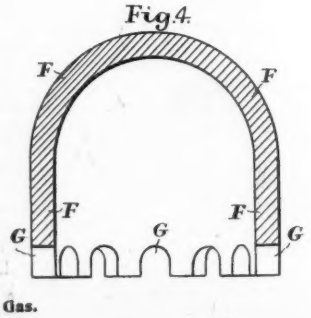


Fig. 4.



Davidson's Plant for the Purification of Illuminating and Coke-Oven Gas.

factory temperature for the liquor in the top chamber; but it may be led in quite cold. The temperature of the middle of the portion may be increased above the ammonia outlet (the best position can readily be found by experiment in each plant), if found desirable, by introducing steam or heated liquor at L. The liquor in this case may be heated by arranging for its conveyance in close proximity to the pipes for the outlet of the liquor which has been deprived of its ammonia, or the pipes for the effluent gases, so that a heat interchange is effected in the known manner.

The sulphuretted hydrogen and carbon dioxide passing off together from the upper part of the still carry away a small quantity of ammonia, which may be recovered in the known manner by passing the mixed gases through absorbers—vessels containing water, or scrubbers providing contact with water or acid. The gases may then be treated in the usual manner in a Claus sulphur kiln, or the sulphuretted hydrogen is oxidized to sulphuric acid or to sulphur dioxide, which is afterwards extracted by means of ammonia to form an ultimate product—ammonium sulphate. The carbon dioxide may be allowed to pass into the atmosphere as it is freed from sulphuretted hydrogen and sulphur dioxide.

The patentee says he prefers, but it is not essential to the process, to treat the gas to be purified, which has passed the ammonia washers or scrubbers, in a suitable washer with a sludge of ferrous hydrate, prepared from a ferrous salt (sulphate or chloride) and ammonia liquor, preferably purified to ensure the complete removal of sulphuretted hydrogen. The sludge may be introduced into the washers and the spent sludge removed at the bottom without interfering with the continuity of the process, which is in contra-distinction to the use of hydrated ferric oxide in open boxes from which it has to be removed and revivified—as the passage of the gas to the box has to be interrupted while this revivification takes place. The spent sludge will contain ferrous sulphide and ammonium salts. The ammonium salts are recovered as such. The ferrous sulphide is treated with acid (sulphuric or hydrochloric) for the purpose of driving off sulphuretted hydrogen, which is used partly for sulphiding lime and partly for the manufacture of sulphur or sulphuric acid.

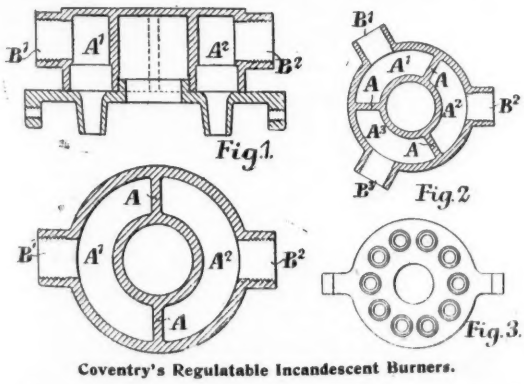
In this operation, a certain quantity of ammonium prussiate is produced, and if the gas plant is worked on a scale sufficiently large to render it a profitable undertaking to extract the hydrocyanic acid from the gas, it may be removed and prussiate and sulphate recovered, as follows: There is interposed before the iron sludge washer just described a primary washer, in which a sludge, consisting of ferrous hydrate with a small amount of ferrous sulphide and some ferrous carbonate, is used. The spent material from the iron sludge washer above described may be transferred to this primary washer, and the finished sludge from this first washer is eventually worked up so as to recover prussiate, sulphate, sulphuretted hydrogen, and residual iron. If desired, an acid solution may be used to extract from the gas which has passed the scrubbers the last traces of ammonia; and when this solution is sufficiently concentrated, it may be neutralized by purified ammonia liquor; whereupon crystals of ammonium salt separate out and are collected and dried by the usual means.

Incandescent Gas-Burners.

COVENTRY, W., of Pendleton, Lancs.

No. 28,898; Dec. 22, 1911.

This is an "improvement" on patent No. 3786 of 1909, as the patentee finds that when annular burners for incandescent gas lighting are made of large diameter and with a single gas inlet chamber "it is not practicable, with gas at a low pressure, to draw in sufficient air, or to obtain an even distribution of the mixture of gas and air over all the gas outlet perforations at a pressure high enough to incandesce the mantle equally at all points." His invention therefore consists in a burner divided by partitions into two or more chambers, and fitted with a corresponding number of gas and air inlet pipes—one to feed each compartment of the burner. A very even distribution of the gas and air to all the nozzles of the burner is thus obtained.



Coventry's Regulatable Incandescent Burners.

Fig. 1 is a sectional elevation and plan showing a burner with two compartments. Fig. 2 is a sectional plan showing three compartments. Fig. 3 is a plan of the underside showing the nipples, nozzles, or perforations of the burner.

The burner is annular in shape, as described in the 1909 patent, and divided into compartments A^1, A^2, A^3 by partitions A, preferably cast with the body of the burner. To each compartment a separate inlet pipe B^1, B^2, B^3 is connected, so that the gaseous mixture is supplied to the several compartments independently of one another, but at the same pressure. The inlet pipes may either be distributed round the burner as shown, or else placed side by side and regulated either individually by separate valves or collectively.

This construction of burner is said to enable only a part of the mantle of the burner to be ignited at one time; so that one or more sections of the burner can be employed according to the intensity of the light required.

Incandescent Gas-Mantles.

ZDANOWICH, J. O., of South Kensington, S.W.

No. 27,354; Dec. 6, 1911.

According to this invention, incandescent gas-mantles are "caused to adhere to their supports by impregnating the cords or threads by which the mantles are attached to their supports (or even the upper parts of the mantles themselves) with a solution of metallic or other inorganic salts which fuse at a low temperature and subsequently fusing the salts, so that they not only permeate the portions of the oxide skeletons of the mantles in contact with the supports, but spread upon the surface of the latter and serve as a flux which promotes the fusion of the mantles to the supports."

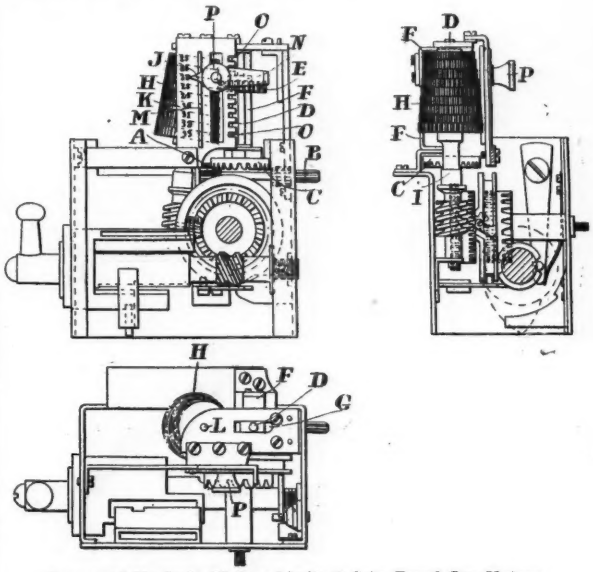
In carrying out the invention, the fusion is effected during the incineration process; and the preferred method is to saturate a cotton, flax, or other combustible thread or cord with a solution of a mixture of salts which, when fused, intimately mix with the oxide skeletons and the supports, and form a practically non-hygroscopic material, which is not fusible at the temperatures that obtain when the mantles are in use. The patentee finds that a mixture of borates, carbonates, and phosphates of sodium, potassium, or ammonium, gives good results; but these are mentioned as examples only—the compounds available being "extremely numerous," and various salts or mixtures of salts being capable of being used, in various proportions, to meet special circumstances.

Coin-Freed Prepayment Mechanism.

BERRY, J., and MAYLOR, J. A., of Oldham, and METERS LIMITED, of Manchester.

No. 3075; Feb. 7, 1912.

This coin-freed prepayment mechanism is of the kind used in connection with gas-meters, for which purpose it has heretofore been proposed to employ "a mutilated gear element coacting with an axially movable gear wheel," and also screws of various lengths in combination with devices for controlling the gas-valve. The present invention comprises the provision in the gear train between the metering and coin-controlled mechanism of variable speed gearing giving continuous but variable rates of movement to the means whereby the gas-valve is controlled, so that the delivery through the valve for each coin inserted in the prepayment mechanism can be varied.



Berry and Maylor's (Meters Limited) Coin-Freed Gas-Meters.

The illustration shows a front elevation, an end elevation, and a plan of a portion of the prepayment mechanism of a gas-meter having the invention applied to it.

There is provided a long pinion A upon the shaft or spindle B operated by the usual metering mechanism; the pinion engaging the teeth of a crown wheel C upon a spindle D, upon which the pinion E is mounted so as to rotate with it, but to be capable of free longitudinal movements on it. The spindle D is carried by a frame-like member F capable of out-and-in movements at right angles to the axis of the pinion. The upper and lower ends of the member F project into slots G in a fixed part of the prepayment mechanism, whereby they are guided in their out-and-in movements. The pinion E is adapted to engage with one or other of the wheels H, which transmit the movements of the meter shaft or the spindle B to the prepayment mechanism (of known form).

Assuming that the meter is to be set to give for each coin inserted the largest delivery of gas for which the meter is designed, the member F is moved so that the pinion E which it carries is drawn clear of the gear-wheels H. The pinion is then slid opposite to the largest size of wheel and moved into engagement with it. The coin-operated valve-controlling device then takes a maximum period after the insertion of each coin to come into action for closing the gas-valve. If the pinion E is moved into engagement with a smaller diameter wheel, the valve-

controlling gear is actuated more rapidly, and the quantity of gas delivered per coin inserted is then reduced.

There is an index or pointer J and scale K in conjunction with the pinion E for indicating the amount of gas to be delivered per coin for any position of the pinion. The device may comprise a finger-like member having a slot in it adapted to engage a projecting strip M, and also a projection N adapted to enter any one of several slots O—each slot corresponding to a position of the pinion opposite one of the gear-wheels. A milled nut P in combination with a screw-device acts to lock the member J, and the movable pinion E to which it is attached, at one end in the desired position.

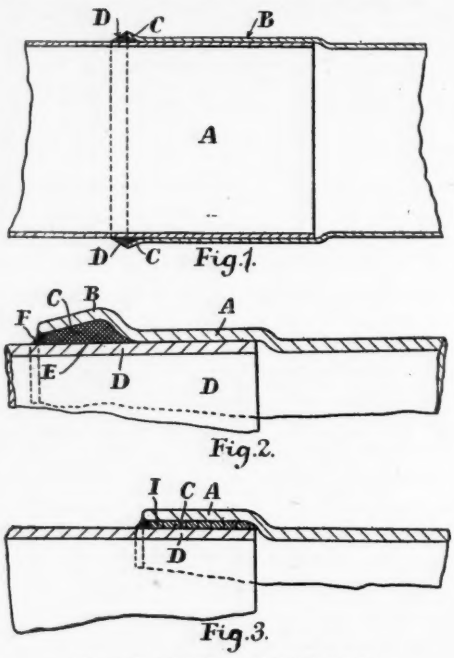
The shaft or spindle I carrying the gear-wheels is set in an inclined plane (as shown) relatively to the axis of the spindle D carrying the movable pinion E.

Welded Joint for Pipes and Tubes.

STEWARTS AND LLOYDS, LIMITED, and STEWART, J. G., of Coatbridge.

No. 6172; March 12, 1912. No. 13,470; June 8, 1912.

At present it is usual, the patentees remark, when jointing iron or steel pipes and tubes by autogenous welding, to have the sections or lengths of the pipe lines slightly scarfed or bevelled at the ends, and to butt the scarfed ends together; the jointing metal and the pipe ends being then brought to a welding heat by an oxy-acetylene or other flame. Such welding can be accomplished in a fairly satisfactory manner, they remark, in cases where the pipes can be turned round; but in cases where the pipes cannot be turned, the operation is not only difficult and dangerous, but the result is usually unsatisfactory. Such butt-welded joints are apt to break readily under bending strains and strains arising from expansion and contraction and other causes; and, in the case of gas and other mains laid in roadways, also under the vibrations produced by the passage over them of heavy motor vehicles.



Stewarts and Lloyds' Welded Joints.

Under the present invention, the joint is made with a spigot and faucet connection of sufficient length and tightness to prevent transverse strains acting on the weld, "which latter is effected at the end of the faucet, and can be done in a thoroughly reliable manner and without danger to the operator." The long faucet constitutes a supporting sleeve, and renders the joint rigid, while the weld ensures fluid tightness. They prefer to make both the faucet and spigot slightly tapered to ensure a tight fit. The end of the faucet is splayed-out or enlarged slightly, so as to leave an annular recess or groove between the faucet and the spigot sufficiently large to receive a portion or the whole of the additional metal for forming the weld, and which enables the weld to be easily effected without turning the pipe.

In fig. 1 is shown, by way of example, a section of a welded joint in accordance with this invention. A is the spigot end of the one pipe length, and B the faucet end of the other. The faucet has a bell-mouthed or splayed-out part C. D is additional metal for the weld.

Under the second patent, instead of obtaining the necessary transverse strength by using a long supporting sleeve into which the spigot fits tightly, a space is left between the spigot and faucet, and this is packed (either wholly or partially) with suitable metal for effecting the autogenous weld; the packing being inserted with sufficient tightness to form a rigid joint, so as to take transverse strains off the actual weld.

Fig. 2 shows a spigot and faucet joint in which the faucet has an enlargement for the reception of metallic packing. Fig. 3 shows a joint in which rings are used as packing.

In fig. 2, the faucet A is made with an enlargement B at its end; a packing space C being left between the enlarged part and the spigot D. The space C is tightly packed with metal turnings E, and when effecting the weld at the end of the faucet, the exterior portion F of the packing is brought to the necessary welding heat. When the space between the spigot and faucet is but partially filled with metal, the remaining space may be packed with refractory material.

In fig. 3, a plain spigot and faucet joint is shown; the space C between the spigot and faucet being packed with rings I, all of metal or only the outer one. In this case, the outer ring serves for the uniting metal of the autogenous weld.

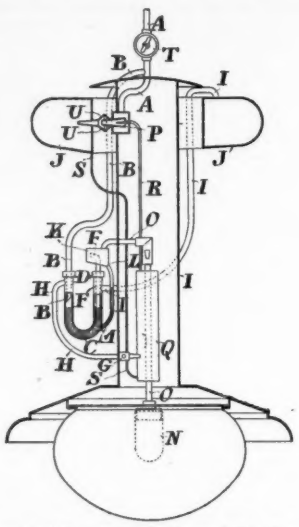
Compressed-Air Arrangement in Gas-Lamps.

OLSO-LICHT-GESELLSCHAFT, HALBMAYR, AND CO., of Vienna.

No. 14,546; June 21, 1912. Convention date, June 22, 1911.

This invention relates to apparatus for generating compressed air or compressed gas especially for lighting and heating purposes, "of the type comprising a system of intercommunicating vessels in which a vaporizable substance—for instance, mercury—is subjected, by heating and subsequent condensation, to a cycle process, and also comprising at the point where the substance is in the vaporous state a device which is operated by the flow of the vaporized substance to deliver compressed air or compressed gas."

The present invention provides such apparatus with a controlling device in which a column of liquid closes the supply pipe of the pilot burner and opens the supply pipe of the main burner when the mixture of gas and air has acquired sufficient pressure, but closes the supply pipe of the main burner and opens the supply pipe of the pilot burner when the pressure of the gas-and-air mixture drops.



An Austrian Compressed Air and Gas Burner.

As shown, a pipe B, branching off the gas supply pipe A of the lamp, extends into one limb of a U-tube C. Both limbs of the U-tube are closed gas-tight at their upper ends by lids D. A pipe F extends into one limb to a greater depth than does the pipe B into the other limb. A pipe H, leading to the pilot burner G, branches off one limb, and a pipe I branches off the other one. The pipe I is connected to a receiver J, which receives the mixture of gas and air. The pipe F opens into a closed box or chamber K having an inclined bottom L, from the lowest point of which a pipe M leads to the U-tube. A supply pipe O leads from the top of the chamber K to the main burner. The U-tube is filled with liquid (preferably mercury) to such a level that the end of the pipe F dips into the liquid while the end of the pipe B does not do so.

The gas supply pipe A leads to a nozzle P which extends into the receiver J. Surrounding the burner supply pipe O is a cylindrical vessel Q, containing liquid, from which a pipe R leads to the nozzle P. A pipe S leads from the receiver J to the vessel Q. When the gas-cock T is opened, the gas flows through the pipe B, one limb of the tube C, and the pipe H, to the pilot burner G, where it is ignited and, in burning, heats the vessel Q. Since the liquid column in the tube C closes the end of the pipe F, no gas can pass for the moment into the burner-tube O and therefore to the burner N; and the small amount of gas which passes through the nozzle P into the receiver J will accumulate in the latter. The pilot burner G now heats the vessel Q, which is full of (say) mercury, which is converted into vapour, which passes thence through the pipe R to the nozzle P. The jet of mercury vapour issuing from the nozzle draws in air through the apertures U and also draws in gas from the pipe A.

The mixture of gas and air thus formed is forced under pressure into the receiver J, whence it passes through the pipe I into the U-tube. When finally the mixture of gas and air in the receiver J has acquired sufficient pressure, the column of liquid in the tube C (which has been filled to a level suitable for the purpose) is forced down in the right limb to such an extent as to unclose the end of the pipe F. The gas and air mixture now passes through the pipe F, the chamber K, and the burner pipe O to the main burner N, where it is ignited by the flame of the pilot burner G. The liquid column in the tube C which has been forced down in the right limb rises in the left limb and closes the end of the pipe B, so that now no gas can pass to the pilot burner, and the flame is extinguished.

The mercury vapours issuing from the nozzle P become condensed in the receiver J, and flow through the pipe S back into the liquid vessel Q. Any liquid particles that may have been carried over from the tube C by the gas-and-air mixture collect in the chamber K and flow, through the pipe M, back into the tube C. When the lamp is extinguished, and therefore the generation of a gas-and-air mixture under pressure ceases, the liquid column rises in the right limb of the tube C until it stands at the same level in both limbs—closing the end of the pipe F, but leaving the end of the pipe B open as before, so that the gas can now pass again to the pilot burner G.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas Analysis Methods.

SIR,—I notice on p. 950 of his article upon the "Calorific Control of Gas Making: Its Use and Limitations," in your current issue, that Mr. Jacques Abady would have your readers believe that the usual "explosion method" of determining hydrogen and methane in the analysis of coal gas is unreliable, and should be discarded in favour of a process of "fractional combustion" in contact with a hot surface of cupric oxide, which (as is averred) at "dull red heat . . . only oxidizes hydrogen and at bright red heat oxidizes methane."

It is with great reluctance that I should venture to utter a *caveat* against the judgment of so eminent and zealous a worker as Mr. Abady. But lest your readers should be too readily influenced by such statements as above referred to, without examining the matter for themselves, I desire to take this opportunity of recording my opinion (based, as it is, upon upwards of twenty years' continuous experience of gas analysis methods under circumstances necessitating the highest degree of accuracy) that the "explosion method," if and when carried out by a competent analyst, is not only absolutely reliable, but also, in point of accuracy, much to be preferred to the "cupric oxide combustion method," which latter, indeed, I cannot recommend.

The fact is, gas analysis is, and must be regarded as, "an exact art," proficiency in which is only attainable after much practice under an experienced instructor, and ought never to be entrusted (as is too often the case) to some unskilled youth with an Orsat or Hempel apparatus. Like the artist's colours, it must be "mixed with brains;" otherwise it is best left alone. But the suggested substitution of the "copper oxide combustion" for the usual "explosion" method is, in my opinion, to be deprecated, in the interests of accuracy.

WILLIAM A. BONE.

Imperial College of Science and Technology, London, Dec. 27, 1912.

The Nottingham Vertical-Retort Installation.

SIR,—In your article on vertical retorts at Nottingham, you mention that the Nottingham Gas Committee, at the time of their visit to the Continent, recognized "the unfortunate condition that by this system (meaning the Dessau) considerable difficulty was experienced in producing gas of sufficiently high illuminating power to comply with the standard to which the Committee were then working."

It would be interesting to know upon what experience this statement is made, because we thought that the bogie of illuminating power in connection with the Dessau system had long since been laid; English working experience having proved that this system is fully capable of satisfying any reasonable requirements in this respect. We happen to have before us, for example, the results of a test made by an independent and thoroughly competent authority, for the express purpose of ascertaining, among other things, the suitability of the Dessau system for maintaining a fairly high standard of illuminating power. These show yields of over 13 000 cubic feet per ton of 21·60-candle gas (No. 2 burner) without steaming, and 14,200 cubic feet per ton of 19·22-candle gas (No. 2 burner) with steaming; the calorific value being practically the same in each case—namely, about 650 B.Th.U. gross. This is only one of many instances which might be quoted as showing that the doubts which were entertained on the subject at the time of the introduction of the system into England have no foundation in fact. On the contrary, it is claimed with confidence that the illuminating power to be obtained by this system is quite as high as, or even higher than, that which can be obtained by any other system of verticals.

The concluding paragraph of Mr. Drury's paper on the Sunderland installation of Dessau verticals [see "JOURNAL" for June 20, 1911, p. 857] succinctly sums up the result of his lengthened experience with it, as follows:—

> The system has proved itself capable, if desired, of producing gas of a comparatively high illuminating power, and also affords facilities for stretching the make of gas to varying degrees of lesser illuminating power by means of its steaming arrangement, showing it to be a plant of very flexible character.

C. HOLMES HUNT, Secretary.

Vertical Gas-Retort Syndicate, Limited, 17, Victoria Street, S.W., Dec. 28, 1912.

Stresses in Roof Trusses.

SIR,—Mr. F. S. Cripps's remarks, as published in the "JOURNAL" for the 24th inst., express in more forcible language the object of the article referred to.

The engineer whose energies are so largely absorbed in the management of gas and water undertakings is more likely to fall into error than his more fortunate *confrère* whose time is solely occupied in constructional work.

This was my only apology for writing the article.

Clevedon, Dec. 27, 1912. JOS. HARGER PYE.

Rate Statement, 1912-13.

SIR,—Mr. G. G. Catt, the Secretary and Manager of the Brompton, Chatham, &c., Water-Works Company, has written me pointing out an error in my statement as to water charge at Chatham.

The quarterly charge of 4s. 6d. was inadvertently given under the head of "Amount in the Pound." The correct amount is 1s. 2½d.

Mr. Catt desires me to ask you to correct in the "JOURNAL" the statement, so far as it relates to his Company.

Preston, Dec. 20, 1912. JAMES CARTER, Borough Treasurer.

Coal Gas and its Competition with Mond Gas.

SIR,—At the close of the article on "Mond Gas" in your issue of the 17th inst., you say that if town's gas can be obtained at a price of from 1s. 6d. to 2s. per 1000 cubic feet, manufacturers will take it in preference to using plant for the production of suction gas.

During the past summer, the Electric Supply Company at Malton, who run two 50 B.H.P. gas-engines for generating electric current, were faced with some considerable repairs and renewals of their suction gas plant. They approached the Malton Gas Company to ascertain upon what terms they would supply them with coal gas; and, after due consideration and some negotiation, it was offered to them at 1s. 6d. per 1000 cubic feet net.

This price, however (low as it was), the Electric Company declined; stating that it was more economical for them to use suction gas, unless coal gas could be supplied to them at 1s. 3d. per 1000 cubic feet.

The quantity they would have taken would probably have been 5 million feet per annum and upwards.

HENRY TOBEY.

Malton, Dec. 21, 1912.

The Candy "De Chlor" Filter at Reading.

SIR,—In the "JOURNAL" for the 24th inst., containing a report of the papers submitted by Drs. Kemna and Thresh to the Institution of Water Engineers at their annual meeting in London on the 14th inst., and the remarks to which they gave rise, I am reported to have said with reference to the Candy "De Chlor" filter that I have had twelve years' experience of it. This is not correct. What I said was: "I have had over two years' experience with the chloride of lime process in the Candy 'De Chlor' filter, during which time bacteriologists who have examined the water treated by this filter have never yet been able to detect the *bacillus coli* in 100 c.c. of the water; and so satisfied was I that a plant had recently been installed capable of dealing with a million gallons of water per day."

The Candy Filter Company, I know, have made filters for many years, and have a well-merited reputation for them. Their "De Chlor" filter is, however, in my opinion, one of their most striking successes. It was put into practical use for the first time at the water-works of the Reading Corporation in March, 1910; and the results obtained thereby, proving so uniformly reliable and so satisfactory, induced the Corporation to increase the plant as already mentioned.

LESLIE C. WALKER, Water-Works Manager.

Reading, Dec. 24, 1912.

LEGAL INTELLIGENCE.

CONTRACTORS' CLAIM AGAINST THE METROPOLITAN WATER BOARD.

HIGH COURT OF JUSTICE.—Dec. 20.

(*Before the* OFFICIAL REFEREE, Mr. EDWARD POLLOCK.)

Pethick Bros. v. Metropolitan Water Board.

In this case the plaintiffs were Messrs. Pethick Bros., Contractors, of Laira Bridge, Plymouth; and they sued the defendants for £16,121 7s. 4d., balance alleged to be due in respect of the construction of filter-beds and reservoirs at Long Ditton, Surrey.

The facts of the case were as follows: By a contract entered into in writing between the parties on Dec. 28, 1906, the plaintiffs agreed to carry out the works in question at Long Ditton at a total cost of £54,783. The plaintiffs said they were allowed to continue the work till October, 1907, when the defendants wrongfully refused to permit them to complete the work, dismissed them from the site, and wrongfully used their tools, material, and plant in getting others to finish the work. Defendants admitted that the contract was entered into, but said there was a clause in it which provided that the work should be completed and delivered up within eighteen months, and that three of the filter-beds, and so much of the pipes and lines, &c., as was necessary to ensure their proper working, should be completed within six months from the date of the Engineer's certificate to commence the work, and the whole of the works to be a complete and perfect contract. Another clause said that if the Contractors, during the continuance of the works, should, in the opinion of the Engineers, fail to proceed with the works with such diligence as to ensure their completion within the time specified, the Water Board might determine the contract, take possession of the materials, tools, &c., and complete the work themselves. On Jan. 7, 1907, the Engineer of the plaintiffs ordered the work to begin, and defendants said that in October of the same year the whole of the contract was greatly in arrear; the result being that defendants' Engineer reported to the Works and Stores Committee of the Water Board that, in his opinion, the Contractors had not proceeded with the execution of the works with such diligence as to ensure their completion within the specified time. The defendants thereupon determined the contract. Defendants denied that there was a sum of £16,121 7s. 4d. due to the plaintiffs; but they expressed their willingness to credit them with £12,223, as against a counter-claim of £13,617 odd in respect of charges incurred by the Board in securing the completion of the contracts by other firms, which left £1394 6s. 5d. due to defendants.

Mr. A. A. HUDSON, K.C., and Mr. INMAN appeared for the plaintiffs; and Mr. HOLMAN GREGORY, K.C., and Mr. J. GOODLAND represented the defendants.

Mr. *Arthur Pethick* gave evidence in support of his case, and was severely cross-examined by Mr. GREGORY to show that the claim was not well founded.

Mr. *Frank Pethick*, who was in charge of the works, also gave evidence concerning the washing of the material for the filter-beds. This was a most important matter, and governed the operations as a whole

so far as time was concerned. He had no idea, at the time when the contract was determined by the defendants, that they would not be able to complete it within the specified period.

At the close of the plaintiffs' case,

The OFFICIAL REFEREE intimated that he should not call on the defendants to produce their evidence.

Mr. HUDSON said he should not be able to proceed with certain parts of the reply and defence to the defendants' counter-claim.

Considerable legal argument followed.

The Judgment.

The OFFICIAL REFEREE, in giving his judgment on the legal arguments raised in the course of the case, said the claim was for alleged breach of contract because the defendants wrongfully seized plaintiffs' plant and materials and refused to pay them the balance due for work done. It was also said that the Contractors lost considerable profit on the work. Defendants made a general denial of plaintiffs' claims, and said clauses in the contract entitled them to determine it, as plaintiffs failed to make sufficient progress with the work. They disputed the value of the work done and the profit, and denied plaintiffs' right to recover. Defendants also counter-claimed in respect to alleged extra cost to them by reason of the failure of the Contractors to perform their obligations. By clause 30 of the contract, the plaintiffs bound themselves to complete and deliver the work within eighteen months, and to construct and deliver three of the south-eastern filter-beds within six months of the commencment of the work. Clause 36 made time the essence of the contract. The contract began on Jan. 23, 1907; but as early as the next month there were complaints, as no turf had been cut by Feb. 6. On May 11, the Clerk to the Board wrote to plaintiffs saying the work was being proceeded with in the most unsatisfactory manner, and pointed out that failure to proceed might mean difficulties with the water supply of the Metropolis, for which the Board would hold the Contractors liable. In June, the plaintiffs became apprehensive that there was little or no chance of them completing the work by the stipulated time, and they asked for leave to do certain operations by night. On the 1st of July, the Chairman of the Board asked the Contractors if they would be able to complete the work by July 7, 1908, and Mr. Pethick said he did not think they could do so. No resolution was come to by the Board at that meeting, nor was any statement made to the plaintiffs as to what it was proposed to do. In August, further complaint was made of delay, and plaintiffs suggested some variation of the contract, which was not attended to. By Oct. 2, the work was in a state of hopeless delay; and on that date, in accordance with the powers under the contract, the defendants' Engineer certified that the Contractors were not proceeding with the work with due diligence so as to complete the contract by the stipulated time. On this, the Board determined the contract on Oct. 12. On these facts various contentions were made; the defendants calling no evidence, but relying on the plaintiffs' evidence and the correspondence. It was said for the plaintiffs that the Engineer's certificate was bad on various grounds; but there was no reason for this. In his opinion, it was clear from the evidence that there was gross delay on plaintiffs' part in the execution of the work, and it was admitted they were unable to complete it in the time stipulated. He found no delay on the part of the Board, nor was there any agreement to waive the date for final completion. There was no power on the part of the Board to make any new agreement except under the seal of the Board; and it was obvious the Contractors could not suggest that the Board had made any contract to extend the time for the completion. Nothing whatever took place to justify the supposition that the Board in any way gave up their right to insist on the whole of the work being done by July 7, 1908. He held that the Board were quite justified in acting on the certificate of the Engineer, and determining the contract and taking possession of the works as they did. As to the loss of profit alleged on the part of the plaintiffs, he thought if they had been compelled to go on with the contract they would have sustained very heavy loss. The grounds of the plaintiffs' contention had therefore failed; and on the question of the defendants' counter-claim and the amount the plaintiffs might be entitled to with respect to the work they had done, and whether they were entitled to anything beyond that which the surveyors had agreed upon—that could be discussed at a future hearing, when the figures would be considered.

Former Gas Company's Secretary Charged with Fraud.

At the Bow Street Police Court, last Saturday, before Mr. Curtis Bennett, Robert Henry Rushforth (43), Solicitor and Clerk to the Justices of Amersham, was charged with forging and uttering a receipt for £40. Mr. Sefton Cohen, who appeared on behalf of the Director of Public Prosecutions, said the prisoner practised as a solicitor at Amersham, where he held a number of public appointments. He was formerly Secretary of the Amersham Gas Company, which went into voluntary liquidation in September, 1910. In June last, he was directed by the Board of Trade to forward to the Registrar of Companies money he had received as Liquidator of the Company—he having previously furnished a statement showing that he had in hand a sum of £215 belonging to the shareholders. He did not comply with the directions, and an order was made by Mr. Justice Swinfen Eady requiring him to pay the £215 within four days. This order was not complied with; and on Sept. 7 prisoner was served with notice of motion on behalf of the Board of Trade. The motion was heard by Mr. Justice Avory on Sept. 11, when Rushforth produced an affidavit to the effect that he had paid to the shareholders the whole of the £215, with the exception of £10. One of the shareholders—a Miss Anna Mary Grimsdale—was shown as having received £40. He duly forwarded eight receipts, one of which purported to have been signed by Miss Grimsdale. Inquiries which were made revealed the fact that the lady had not given the receipt. It was, however, fair to the accused to state that he paid the £40 to Miss Grimsdale on Sept. 21, ten days after the production of the affidavit. On being arrested, Rushforth said he had paid everybody, and there had been no intention to defraud. The Magistrate ordered a remand; allowing bail in two sureties of £250 each. Later in the day, however, he agreed to reduce the bail to two sureties in £150 each; and two gentlemen were accepted as bail in this amount.

MISCELLANEOUS NEWS.

SINGAPORE GAS UNDERTAKING.

An illustrated description was given in a recent issue of an installation of vertical retorts on the "Elland" system which Messrs. Rober Dempster and Sons, Limited, are to provide for the municipal gas-works at Singapore; and this may now appropriately be followed up with a few particulars, extracted from the report of the Gas Engineer (Mr. J. P. Hallaway), regarding the working of the gas undertaking over the latest available period—the year 1911.

After remarking that during 1911 the make of gas per ton of coal was 12,787 cubic feet, against 12,608 cubic feet in 1910, and that owing to the large increase in the amount of gas manufactured all the existing retorts, with the exception of one single setting, were in use, Mr. Hallaway stated that, in order to carry on until arrangements had been made for new carbonizing plant, it would be necessary to at once put in hand further extensions. For the purpose in view, he expressed the opinion that the erection of a small water-gas plant would be desirable. Other work on order or in course of erection included new exhausters, purifiers, washer-scrubber, station-meter, governors, and gasholder repairs—the contract for all of which was obtained by Messrs. Clayton, Son, and Co., the sub-contractors being Messrs. Clapham Bros. for the purifiers and washer, and Messrs. Parkinson and W. & B. Cowan for the station-meter and governors. It had also been decided to provide for the rapidly increasing output of gas by the installation (in addition to the new carbonizing plant, with coal-handling machinery), of a new gasholder, new condensers, and a high-pressure feeder main with pumping plant and district governors. A large number of mains will require to be renewed during the next few years, to provide for the growing demands on the undertaking.

At Dec. 31, 1911, there were 2524 wet meters in use, and 21 dry. The amount of gas manufactured for the year was 106,884,300 cubic feet, against 89,293,200 feet for 1910—an increase of 17,591,100 cubic feet, or 19·7 per cent. This is the largest increase during one year since the works were taken over by the Municipality. The gas used for public lighting was 41,848,953 cubic feet, which was equal to 39 per cent. of the quantity sent out; and during the year fifty additional public lamps were fixed. The sales of gas for private lighting amounted to 60,775,094 cubic feet, as compared with 44,270,056 cubic feet for 1910—an increase of 16,505,038 cubic feet, or 37·2 per cent. The increase in the number of consumers was 658, against 646 in the preceding year. The amount of gas sold for private lighting was equal to 56·8 per cent. of the output, as compared with 49·6 per cent. for 1910, and 30 per cent. ten years ago. Referring to these figures, Mr. Hallaway says: "This increase in private sales is most satisfactory, and there is every indication that it will be maintained. The increase is in great measure due to the reduction in the price of gas, which is now as cheap as oil, and much more cleanly and convenient, with a greatly improved light for the same expenditure." The quantity of gas accounted for per ton of coal carbonized was 12,421 cubic feet, which was an increase of 271 cubic feet over the previous year. The amount of unaccounted-for gas was 2·9 per cent. of the quantity sent out, a figure which compared with 3·6 per cent. for 1910.

In July, 1910, the price of gas to ordinary consumers was reduced from $2·70 to $2·25 net; to consumers of 50,000 cubic feet per month, from $2·55 to $2·25 net; and to consumers of 100,000 cubic feet per month, from $2·25 to $2 net. The total number of private consumers at Dec. 31, 1911, was 2545, and of public lamps 2275 The net profit made by the department for 1910 amounted to $70,229; and in view of the large increase in sales during 1911, Mr. Hallaway did not anticipate that there would be a falling off in the profits for that year in consequence of the reduction in price.

EDINBURGH PUBLIC LIGHTING.

Report of the Inspector of Cleaning and Lighting.

The report of the Inspector of Cleaning and Lighting for the City of Edinburgh—Mr. George A. D. Mackay—for the year ended May 15 last has been issued. In his introductory statement, he says there is practically nothing of outstanding moment to be recorded in connection with the incandescent gas lighting of the streets. He remarks, however, that the position of Edinburgh in regard to public lighting is a prominent one, "as a stage of effective lighting has been reached which not only commands the approval of the citizens, but attracts the attention of visitors, and elicits commendation from other municipalities." There is one fault, however, he says, which many have to find, and which has been the source of grievous complaints, and that is that during the summer months the system of half-lighting is in operation. This means that from May 1 to Aug. 31 only half of the lamps are lighted; and from Sept. 1 to April 30 every alternate lamp is darkened at midnight. Mr. Mackay says this arrangement cannot be said to be a popular one; and he is of the opinion that full lighting should be restored, as it was in existence in 1907, as soon as possible. On special occasions, it is pointed out, there is full lighting, such as on the New Year holidays, parliamentary elections, &c.

There are under the control of the Lighting Department 11,699 lamps, including 10,416 incandescent gas-lamps with 10,479 jets. On May 15, 1911, the total number of incandescent gas-lamps was 10,357, with 10,416 jets. The burners of the incandescent lamps are regulated to consume 2¼ cubic feet of gas per hour; and the light is equal to 17½ candles. In a comparative table, it is shown that since 1890 the number of street gas-lamps has risen from 9586 to 10,416 in 1912. It is pointed out that 113 lamps are still required for the unlighted areas of the city. The incandescent installation in common stairs has proved very satisfactory from the point of view of effective lighting, when the burner and accessories are in order. Mr. Mackay states,

however, that the breakages of mantles and other defects are so common that frequently portions of a stair are left in darkness until the matter is reported, and put right by the Gas Commissioners. In the year covered by the report, two inspections of the stair lighting were made, each of the 6093 stairs having been visited twice. From Sept. 22 to Dec. 8, 1911, there were 2527 lights in 891 stairs found defective from various causes – principally broken mantles and dirty globes; and from Jan. 10 to April 3, 1912, in 1945 stairs there were 2835 lights requiring attention. The cost, including wages and gas, of lighting common stairs is £12,560, and the charge for street gas lighting, including the cost of gas, lamplighters' wages, and incidental expenses, is £18,488.

With regard to the automatic lighting and extinguishing of public incandescent gas-lamps, Mr. Mackay remarks that, though some corporations have adopted the system by which the lamps are lighted and extinguished by clockwork, Edinburgh has not yet passed the experimental stage. The trials so far made have been unsatisfactory; but further tests are being conducted, and the mechanism is stated to be working well.

FATALITY AT THE BECKTON GAS-WORKS.

An Unguarded Aperture.

At the West Ham Coroner's Court last Tuesday, Mr. G. E. Hilleary held an inquiry relative to the death of Albert Victor Wyatt (20), a stoker employed at the Beckton Gas-Works, who died in the Seamen's Hospital on the 20th inst., as the result of injuries sustained at the works the previous day.

Mr. C. Beasley Robinson (Messrs. Monier-Williams, Robinson, and Milroy) appeared for the Gaslight and Coke Company. Mr. T. M. Barlow, one of His Majesty's Inspectors of Factories, attended from the Home Office.

The Coroner remarked that, as the matter was somewhat complicated, he thought the better plan would be to at once call the Engineer at the works.

Mr. *Joseph Newell Reeson* said they had been reconstructing No. 5 retort-house, and it was set to work about three weeks ago. The settings had been rebuilt, and the coke-conveying plant had been restored. There was a gangway between the end of the retort-bench and the wall; and on the 19th inst. a permanent plate had been placed over the end of the conveyor trough. It had been previously covered by a number of 9-inch planks. There was an endless chain on the trough; but it was not covered, because it was used for conveying the coke as it fell from the retorts. There was a space of some 2 feet between the end of the permanent plate and the end of the trough, and it had been covered by the 9-inch plank and a 2-foot wooden guard. It appeared that some repairs had been done to the sliding plate on the charging-machine, and the plate had evidently fouled one of the guards and pushed it slightly out of position, and there was unfortunately a space left. [Several photographs were handed to the Jury; and witness pointed out the place where the deceased must have fallen.] There was to be a permanent plate fixed; but it was not ready on the day of the accident. He thought the deceased stepped into the aperture, and was dragged along about 12 feet. The machinery was quite modern—absolutely the latest; and the place was well lighted. The deceased had been sent to draw one of the retorts which could not be drawn by machinery; and he (witness) thought that on returning he must have slipped, but nobody saw him fall.

In answer to Mr. Robinson, witness said a notice was posted up to the effect that if there was anything wrong the workmen were to leave the retort-house at once.

Henry Brown, the foreman in charge of No. 5 retort-house, deposed that at six o'clock on the evening of the 19th inst. he stood on the guard over the hole at the end of the conveyor trough. It was all right then, and numbers of men had passed over it during the day. He sent a man mamed Collins and the deceased to draw a retort. Collins asked to have the fire shifted, and witness told the man to start the conveyor. At that moment Collins threw a pail of water on to the coke, which caused steam to go all round the plank. He thought Wyatt must have been walking along at the moment, and the steam blinded him, so that he could not see where he was going; and he then fell through the aperture.

By the Jury: He had never seen the plank moved in any way. The grating was put in position every time they left, and there was no necessity for it to be shifted. He could not account for it being moved. It was quite right when he was there at six o'clock, and at eight it was not. The guard was not broken.

By Mr. Robinson: It was practically a new guard. He could only imagine that the deceased stumbled on the plank through the steam, and fell where he could not be seen.

William Francis Collins gave corroborative evidence.

Francis William Leonard, a boiler maker, stated that he was responsible for the mechanics in No. 5 retort-house. There was a plate about 4 ft. 6 in. from the wall towards the conveyor, leaving a space of about 2 feet. The opening was covered with a 9-inch plank while they were making some hinges; and it was quite safe for anyone to walk over. He could not account for the accident.

Dr. *Charles Morley Wenyon* said the deceased was brought to the Seamen's Hospital on the evening of the 19th inst. suffering from severe injuries to both legs. He was operated upon; but he sank, and died the following morning—the cause of death being shock following the injury.

The Jury, having conferred for some time, returned a verdict of "Accidental death;" adding as a rider that they did not think sufficient precaution had been taken to guard the structure.

Mr. Robinson said the Company would, of course, be quite willing to comply with any recommendation suggested by the Factory Inspector.

A new Company has been registered under the title of B. Cars, Limited, lamp manufacturers, with a capital of £25,000 in £1 shares. The registered address is No. 124, Tabernacle Street, E.C.

ELECTRICITY SUPPLY AT WOOD GREEN.

The Arrangement between the Tottenham Gas Company and the Wood Green District Council.

It will doubtless be remembered that the Tottenham and Edmonton Gas Company have decided to promote a Bill to enable them (*inter alia*) to acquire the electric lighting powers of the Wood Green Urban District Council. The Council are among the few local authorities round London who have not provided their district with a supply of electricity; the result being that the largest firms generate their own current. It is due to the Council, however, to record that they have made several attempts to undertake the business. About twelve years ago, Wood Green and four contiguous districts combined in a proposed comprehensive scheme of electricity generation and distribution; but in the end it fell through. Six or seven years ago, the District Council decided to embark on a scheme of their own, involving an outlay of £60,000. The Local Government Board, however, refused to sanction the loan. Then the Council obtained a Provisional Order from the Board of Trade, the period of which was from time to time extended. Now, as already stated, they purpose selling their Order outright to the Tottenham and Edmonton Gas Company.

At the meeting of the Council held on the 20th inst., a report was submitted upon the general position. It was stated therein that the Council had decided to transfer their Order and all their powers, &c., to the Company, and that the Company had agreed to pay for them the sum of £500, together with the full amount of the costs and charges incurred or to be incurred by the Council in applying for the necessary sanction—payment of such sums to be made on the Bill becoming law. The Company undertake to generate and commence a supply of electricity within a period of twelve months from the date of the transfer of the Order. The actual prices per unit to be charged to consumers must not be in excess of the following: For lighting purposes (private consumers), 5d.; for power, heat, and domestic purposes (private consumers), 2d.; for street lighting, 2½d. in roads or streets in which houses were being supplied by the Company. The Council will have the right, at any time after the expiration of fourteen years, on giving twelve months' notice, to purchase the undertaking, on payment to the Company of the amount of the capital expenditure as shown in the annual statement of accounts duly audited by the Board of Trade, and in addition a sum calculated on the capital expenditure at rates ranging from 20 per cent. if the purchase is made in the fifteenth year, the percentage decreasing 1 per cent. on each additional year's purchase. The Company asked for a protective qualification giving them the right to raise the prices under certain special circumstances; but, as the result of negotiations on the point, the Company withdrew the condition.

In the course of a discussion on the subject, Mr. Holmes said it might be useless to oppose the scheme; but he should do his very best to prevent one Company obtaining a monopoly of both electric and gas light in the district.

Mr. Davies (the Chairman of the Law and Parliamentary Committee of the Council who recommended the scheme) said they could not have done better than they had. He announced that a reduction had just been made in the price of gas.

The Council signified their approval of the scheme.

The North Metropolitan Power Supply Company have given the Council notice of their intention to apply for a Provisional Order for the supply of Wood Green.

MUNICIPAL TRADING IN GAS APPLIANCES.

Local Government Board Inquiry at Rochdale.

An inquiry, by order of the Local Government Board, was held at Rochdale on Friday, the 20th inst., into an application of the Corporation for a Provisional Order to amend the Rochdale Corporation Act, 1872, so as to confer on them further and amended powers with regard to the purchase, sale, letting for hire, fixing, and repair and removal of meters, stoves, and other apparatus for the consumption of gas for lighting, power, heating, and cooking, and also to prohibit fittings let out on hire being subject to distraint for rent. The inquiry was conducted by Mr. R. C. Maxwell, one of the Board's Inspectors.

The Town Clerk, Mr. W. H. Hickson, at the outset of the proceedings, explained that the Rochdale Corporation were simply asking that the powers they already possessed under their Act of 1872 should be brought up to date. It had not to be taken, he added, that these powers had been dormant, as the Corporation had let out on hire gas-cookers, ordinary meters required for purposes other than lighting, and slot meters. Rochdale was one of the few towns where owners provided and fixed meters for lighting. It was not intended to interfere with the practice whereby the ordinary lighting meters were supplied and fixed by the landlord, although under the Act of 1872 they could do so. As regarded the second meter for purposes other than lighting, however, it was the intention of the Corporation to supply and fix it free. Hitherto they had let stoves out on hire, but had not fixed them. It was proposed to continue to allow them out on hire, but to fix them free, and to do the same with radiators and other heating apparatus. The Corporation intended to have a stock of these and other appliances in a show-room for the benefit of all plumbers in the town. They did not expect plumbers would suffer in the least by the change. The idea of the Gas Committee was to increase the demand for these articles, and by the Corporation scheme it would not be necessary for plumbers to keep considerable stocks merely as samples—this would be done by the Corporation in the show-rooms. The Corporation were not putting themselves in competition with plumbers in regard to fixing, for they intended to give full opportunity to all their customers to engage the plumbers of the town for fixing; and he did not think that plumbers need have any doubt about the *bonâ fides* of the Gas Committee in this matter. In answer to Mr. Stubbs, the Town Clerk said he had no figures as to the cost of the proposed development.

The Borough Treasurer said the outstanding debt on the works was

£225,256, and there was £61,391 in the sinking fund; bringing the debt down to £163,865. Last year the net profit was £20,306, of which £16,000 was applied to the relief of the rates. This was equal to a rate of 11·06d. in the pound. In the previous year, £12,000 went to the rates. There was a debit balance on the reserve fund of £1425, which was included in the £17,367 overdraft made in March. During the past two years, there had been £25,000 spent from the reserve fund on capital work. In addition to £25,000 for new vertical retorts, £14,000 had been spent from reserve on water-gas plant, and really £70,000 or £80,000 had been taken from reserve from time to time to cover capital expenditure.

The Inspector said he thought they ought to have arranged so as to avoid an overdraft, as they were giving away money which belonged to other people.

The Town Clerk said that both the gas and electricity undertakings were conducted by the same Committee, and he hoped the time would never come when they would split up into two bodies. The accounts were kept separately.

Mr. Stubbs, representing the master plumbers of Rochdale, said they knew nothing except that their trade would be taken from them.

The Town Clerk said it was impossible to anticipate the business they would do. The work would be given to properly registered plumbers. It was proposed to allow plumbers a trade discount on the sale of fittings. Replying to the Inspector, he said that if a customer went to the show-room and purchased apparatus without a plumber accompanying him, the plumber would not take any discount.

Mr. Stubbs opposed the application, and said that generally they contended it was municipal trading, the result of which would be that master plumbers, and incidentally their workmen, would be wiped-out of existence. The Corporation were embarking on what the plumbers regarded as a very speculative business, and any loss would fall on the general ratepayers.

The Inspector said nothing had been taken from the rates for many years, and much had been given to their relief.

Mr. Stubbs submitted that the work could be done more economically and efficiently by private firms. It was unfair competition with plumbers.

The Inspector said the Town Clerk stated that they would employ the master plumbers and operatives.

Mr. Cox also opposed the scheme. There were between 40 and 50 master plumbers and about 100 operatives in Rochdale.

Mr. Joseph Hill, Secretary of the Manchester District of the United Operative Plumbers' Association, put the case for the operatives, declaring that their experience had generally been that corporations undertaking this work inevitably tended to employ their own plumbers or other men, and that they did not always pay the standard rate. He argued that there had been no demand for the proposed change. To sectionalize the work as suggested would be to split up the plumbing trade and create two trades instead of one, and would tend to reduce wages. Moreover the master plumbers were the men best fitted to supervise the work.

The Town Clerk, in replying, said the Corporation would allow the fullest latitude to consumers to engage private plumbers; but the customer would not be charged for the work.

In closing the inquiry, the Inspector said that, with a little confidence in the Corporation, there need be no practical difficulty.

ENGINEERING PROGRESS IN 1912.

Under the heading of "Engineering in 1912," the "Daily Telegraph" last Saturday contained a well-written review of the progress made in what is characterized as "a year of important developments" by their Engineering Correspondent (who, it may be mentioned, is not the individual whose remarks on subjects in which "JOURNAL" readers are interested were strongly protested against in our columns about a year ago). The following are some extracts from the review.

STEAM-RAISING DEVELOPMENTS.

In the production of power from the burning of coal no great advances have been forthcoming, nor, indeed, are any to be anticipated. Modification in current boiler design can at the most only raise usual boiler efficiency a slight percentage above the normal 70 per cent. figure; and for appreciably increased efficiencies totally different methods of combustion must be looked for. Such a one is apparent in the new Bonecourt boiler, in which a correctly proportioned mixture of gas and air is burnt in a tubular boiler of small size; the tubes being loosely packed with refractory material. High temperatures are developed, exceeding 2000° C.; and with rapid heat transmission, scaling of the boiler is much diminished, and the boiler shows an efficiency of 95 per cent. Add to this the much smaller size of boiler, the availability of different forms of gas fuel, and the simplification in the design, and it will be seen at once that the new boiler is bound to attract considerable attention among engineers. At any rate, coal must be used more efficiently, or if inefficiently employed must be burnt in decreasing quantity till the attainment of such low efficiencies as are commonly used in small units is a thing of the past, and the production of smoke entirely suppressed. Smoke may have its advantages from an agricultural point of view; but it must not be considered the function of the engineer to produce it. How smoke could be prevented was well shown at the Smoke Abatement Exhibition held at the Royal Agricultural Hall in the spring. The use of oil fuels cannot in this connection be forgotten. The coal strike of the early summer gave a unique opportunity for the exhibition of the advantages of this class of fuel; and it will be remembered that of all the railways only the Great Eastern was able to maintain a usual service, and this was the outcome of the use of oil fuel. For steam raising in connection with boilers on land, however, there does not appear to be much promise of the wide use of oil in the immediate future, unless, perhaps, in connection with the new boiler above mentioned. Any large demand would at once influence prices; and the disproportionate charges for transport to the cost of the oil at the wells would seem to indic more advantageous use in localities requiring less transport and lacking in coal.

THE GAS-TURBINE.

The past few years have witnessed in the large development of the steam-turbine the suppression of the reciprocating in favour of the rotary type of prime mover. Moreover, the advantages of the turbine increase with larger units. There is, however, in the development of the high-pressure oil-engine, as in the Diesel engine, a reversion to the reciprocating form; and with the simultaneous erection of gas-engines of great power, it is not surprising that attempts should be made to utilize the combined advantages of internal combustion engines and the turbine principle. On these lines, therefore, gas-turbines have been produced, some of large rating. Recently one of 1000 H.P., running at 3000 revolutions per minute, was described. There are, however, difficulties attached to such units which increase with the rating, while those of the steam-turbine decrease; and the latter is therefore destined to hold its own in the production of power on the large scale from carbonaceous fuels. It is suggested, however, that success with the gas-turbine may be looked for in utilizing the explosive force of the gas to give velocity to water, which would then actuate the turbine. While this would introduce large masses of water, it would nevertheless dispense with the reciprocating parts of the modern gas-engine. In opening-up such new forms of prime movers, there is obviously much pioneer work to be done which cannot bring an immediate reward; and only by careful observation of the behaviour of these engines can the data be forthcoming upon which future progress can be hoped for.

ELECTRICITY REPLACING STEAM.

In the textile industries, electrical driving has largely increased. The system is favoured on account of the steadiness of the drive and the independence of each part of the works thus equipped. Though a few years ago steam was in almost universal use, the advantages of the electric motor are becoming more and more obvious, and the system more in evidence. The extending use of electricity in the handling of heavy goods and coal is apparent in the provision made for electric haulage in the new docks, and in mining the safety of electrical power and light in the hands of the competent engineer is becoming more assured. As a source of power in heavy constructional work, electricity suffers from the varying systems of power in different localities, though here it is not improbable that something may be done to replace the bulky and inefficient steam units by motors supplied for the time by the local supply authorities for service in lifts, hoists, derricks, mixers, &c. In the sphere of electrical generators, some attention has recently been given to the construction of large machines of the homopolar type. A report on such a machine of 2000 kilowatts, which had been in continuous use for some time, shows the manner in which some of the difficulties in the development had been overcome. The obstacles to successful machines of large capacity are such that no immediate prospect appears of their general use.

LIGHTING AND HEATING.

On the lighting side, a noteworthy innovation is that of the drawn tungsten filament lamp. Such a lamp is now capable of withstanding the most severe vibration, and is a marked advance in incandescent lighting. Already its effect is being felt in the increasing demand for current. But a few years ago the introduction of tantalum and tungsten lamps, with their remarkably low current consumption, brought about a surprising decrease of the sale of current for lighting purposes. The increase of lighting which is following and will continue to follow the advent of the tenacious wire-drawn lamp has already compensated for this falling-off; and there is now an assured prospect of electric lighting finding its way into the smallest homes, assisted also by the new and cheapened methods of wiring. Side by side with this there has been a marked development of indirect arc lighting; and it is apparent that both of these systems of lighting, each in its own special application, will do much in the competitive war between gas and electric illumination. Moreover, increased attention is being paid to the lighting of factories, workshops, &c., where illumination and health are closely related. Without entering into any comparison of the two systems, it cannot be overlooked that gas lighting has also made rapid advances, as it is only appropriate it should have done, seeing that the centenary of gas lighting was celebrated during the year under review. Passing along a thoroughfare brilliantly illuminated with the high-pressure gas system, one is forced to admit the beneficial effect of a healthy competition. Electric heating, however, makes slower progress. Its progress must depend upon a considerable reduction in the cost of electricity and more efficient designs in the heaters. Where data are available, they go to show that the load occasioned by heating is not coincident with that of lighting. This should lead to the required reduction; and advance in this direction may be confidently anticipated. A by no means unimportant feature of illuminating engineering is the increased attention which is being given to the accurate measurement of light. The success attending these efforts and the simplification of the apparatus to render it available for use by others than experts, and the more general recognition of the importance of this branch of the science of illumination, will undoubtedly lead to improved methods.

CONCLUSIONS.

May we not conclude from this very limited review of progress that the year has not been uneventful in the industry of engineering? In some directions, remarkable advances have been made. In others, while progress may appear more modest, it must be remembered that each advance possibly makes a further step more difficult. But, viewed broadly, 1912 will in history be associated with a large measure of real progress; in more than one case foundations having been laid upon which the engineers of the future will erect their wonders, Not only have the vast resources of Nature been tapped and harnessed for man's use and comfort, but, by means of intercommunication, engineering science is exerting a moral influence upon nations; and to this high ideal engineers will continue to press forward.

Mr. R. Gamble Marks, of Southport, whose enclosed tins for baking in gas-ovens and oven heat distributors are held in much favour in many towns, has booked up some fifty gas-cookery lectures and demonstrations for the early spring.

STOURPORT WATER SUPPLY.

Proposed Supply from Bewdley.

An inquiry has just been held at Stourport, by Major J. STEWART, R.E., on behalf of the Local Government Board, relative to the application of the Stourport Urban District Council to borrow £1400 for the purpose of carrying out works for obtaining a water supply from the Bewdley Corporation, in lieu of the present supply from the Kidderminster Corporation, whose contract with the Stourport Council expires on the 5th of March next.

The Hon. R. COVENTRY (instructed by Mr. C. H. Watson, the Clerk to the Stourport Council) appeared for that body; Mr. J. H. THURSFIELD, the Town Clerk of Kidderminster, for the Kidderminster Corporation; and Mr. STANLEY HEMINGWAY, the Town Clerk of Bewdley, for the Bewdley Corporation.

Mr. COVENTRY said the Stourport Council were in the position of making the best bargain for the ratepayers. The Kidderminster Corporation had supplied water for thirty-three years, at 6d. per 1000 gallons up to 20 million gallons, and 5d. per 1000 gallons afterwards. Stourport asked for reduced terms; telling Kidderminster they were approaching the Bewdley Council. Kidderminster declined to make any reduction. Bewdley offered 5d. per 1000 gallons up to 20 millions, and 4½d. per 1000 gallons beyond this. The Bewdley supply would be both more economical and more efficient than that of Kidderminster. The distance from the Bewdley reservoir was much less than from Kidderminster; and the present main from the latter place would have to be relaid at no distant date. Besides this, there must be a new main along Bewdley Road, Stourport, which would be unnecessary if the supply was obtained from Bewdley; and the balance was very much in favour of the Bewdley scheme. If they continued with Kidderminster, it meant an additional rate of ½d. in the pound; and if they went to Bewdley, they would save this amount. The cost of the new main to Bewdley would be £1336, whereas the main to Kidderminster would cost £1387, and £514 would have to be spent on the Bewdley Road main. After Stourport had come to terms with Bewdley, an unofficial offer came from the Kidderminster Water Committee; but there had been no offer from the Town Council.

Evidence in support of the case for Stourport was given by the Chairman of the Water Committee (Mr. R. B. Worth), who stated that, since the notice of the inquiry, a circular had been received from Alderman Ray, the Chairman of the Kidderminster Water Committee, offering to supply the water at 5d. per 1000 gallons, irrespective of the quantity used. At that time a firm bargain had been made with Bewdley, which Stourport desired to carry out. Bewdley's offer was a still better one. Mr. Fiddian, on the same side, said he did not consider the present supply from Kidderminster was satisfactory. Bewdley could provide a more efficient service at a saving to Stourport. Mr. R. E. W. Berington, of Wolverhampton, the Water Engineer to the Bewdley Corporation, said there was an ample supply of water, and the machinery was sufficient to supply Stourport and Wribbenhall as well as Bewdley. They could raise 24,000 gallons an hour, and at present they were only having to supply 50,000 gallons a day. The works were in operation only three days a week, and it was a pity they should not be used more.

The case for Kidderminster was supported by Mr. Willcox, the Water Engineer to the Corporation, who said the present main from Kidderminster to Stourport was sufficient. The Kidderminster Corporation spent £20,000 in improving the water-works; and it would be a grave injustice if Stourport ceased taking a supply from them. Kidderminster was prepared to offer the same terms to Stourport as Bewdley, or even better terms. Mr. Millington, a member of Stourport Council, and Mr Southerton opposed the Bewdley scheme. Mr. Mallard presented a petition against it from a large number of ratepayers.

Mr. THURSFIELD said the Kidderminster Corporation opposed the application because they felt they had not been altogether justly treated by the Stourport Council. They were asked to reduce the price of the water; but could not see their way to do so. Only financial reasons were mentioned to them by the Stourport Council; but at the meetings a point was made that the pressure was inadequate, and the question of the mains was raised. Had this been mentioned to the Kidderminster Council, things would have appeared in a different light. Having the full facts before them, the Council had authorized him to offer the water at 5d. per 1000 gallons up to 20 million gallons, and 4½d. beyond this. They would contribute a sum not exceeding £500 towards the laying of a new main in Bewdley Road, which was estimated to cost £514. The effect of the offer would be a great saving to the Stourport ratepayers.

Mr. COVENTRY said the question for the Inspector was what was best in the interests of Stourport, without regard either to Bewdley or to Kidderminster.

The inquiry then terminated.

Woodall-Duckham Vertical Retorts for Bolton.—The Gas Committee of the Bolton Corporation had again under consideration at their last meeting tenders for the installation of vertical retorts at the Lum Street works. Since the previous meeting, the Gas Engineer (Mr. W. J. Smith) had, upon instructions from the Committee, supplied each member with a report on the matter. After full consideration, it was resolved to accept the tender of the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited, for supplying and fixing the installation.

Proposed Reservoirs in Brazil.—According to the Engineering Supplement to "The Times," plans for some important work in connection with the construction of reservoirs in Brazil are being prepared for the approval of the Government. It is proposed to construct a barrage across the River Peixe in the State of Parahyba, which is to create a reservoir of 48,250 million gallons capacity, at a cost of about £200,000. At Oros, in the State of Ceara, it is proposed to form on the Jaguaribe a reservoir which will have a storage capacity of 484,000 million gallons. It is estimated that the cost of the scheme will be about £360,000.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Edinburgh.—Reports on the storm and hurricane which started here on Tuesday afternoon show that a wind pressure of 38 lbs. per square foot was recorded at the Glasgow Observatory; while at Paisley the velocity is stated as 97 miles per hour, which would equal about 45 lbs. to the square foot. The damage to gas-mantles has been high—amounting to about 250 in Paisley; while at Penicuik about eight-tenths of the public lamps were extinguished owing to broken mantles, and the streets were consequently in semi-darkness.

Glasgow.—The members of the Glasgow Corporation Gas Committee recently made their annual inspection of the gas-works. At the subsequent luncheon in the City Chambers, Bailie Paxton, the Convener of the Committee, presided; and, in responding to the toast of "The Gas Committee," he remarked that the inspection was satisfactory to all concerned. He regretted that they did not see the Committee's most up-to-date works—Provan. At Dawsholm, they saw the vertical retorts which were introduced by Mr. Wilson (the General Manager) about eighteen months ago at a cost of £30,000. If they compared these retorts with what they saw at Tradeston and with the old retorts at Dawsholm, they realized how perfect the new apparatus was. They could make gas as cheaply as any other undertaking in Great Britain. The distribution of it had, however, caused a good deal of outlay, so that their gas was not so low in price as that of some of their neighbours. But if all the charges were taken into account, Glasgow gas would come out the cheapest in Britain. Their appointment of a Commercial Manager, Mr. Halkett, who took up his duties two months ago, had had very satisfactory results. To show the extraordinary advance in their commercial department, he might mention that in November, 1911, they fitted 2000 gas cooking appliances, whereas last month the number was 3000. During October, 1911, they fitted 500 gas-fires; in October, 1912, the number was 1500; while last month it was 3100.

Blantyre.—A public meeting of the ratepayers of Blantyre was held on Wednesday night in the Masonic Hall in connection with the movement for a cheaper supply of gas. For some time past, a Committee appointed by the ratepayers have been negotiating with the Hamilton Corporation, who have offered a supply of gas at 10d. per 1000 cubic feet less than at present charged by the Blantyre Gas Company, with a further reduction of 2½d. when the annual consumption reaches 30 million cubic feet. This offer being subject to the approval of the County Council, that authority was approached; and, after meeting with all parties, an expert was appointed to inspect the Blantyre Gas-Works. The report of this gentleman being unfavourable, the County Council agreed to reconsider the position in six months; and this period having now expired, the ratepayers are again taking proceedings. Speeches urging the ratepayers to reaffirm their resolution to press the County Council to take immediate action were made by members of the Sub-Committee on Wednesday night, and eventually Mr. George Crawford's resolution, calling upon the County Council to accept the offer of the Hamilton Corporation and have the scheme carried through without delay, was unanimously agreed to.

Doune.—A poll of the ratepayers of Doune was taken on Friday on the question of acquiring the local gas-works at the price provisionally agreed upon—namely, £1300. There were 89 votes in favour of the proposal, and one against it.

Dundee.—The contracts accepted on Friday by the Gas Committee of the Dundee Town Council for bricks, retorts, and retort-bolts show an advance in prices from 15 to 20 per cent. On the advice of Mr. A. Yuill, the Gas Manager, the Committee decided to accept tenders for current needs after using up the stock on hand. Even under this arrangement the extra cost will be about £2000.

Dunfermline.—The rival schemes for the supply of water in the Dunfermline area still occupy the attention of the Town Council and the county authorities. At a special meeting of the former body on Monday last, held in private, the following notes were afterwards supplied to the Press: "The Council had under consideration two minutes of joint meetings of the Town Planning and Water-Works Committees relating to the meetings which had taken place in London with the Admiralty and in Edinburgh with the Local Government Board, and representatives of the Dunfermline District Committee and of the Admiralty. The Council had further under consideration a letter which had been framed putting in writing the proposals of the Council for a scheme of joint construction of a new reservoir at Glendevon, to which the Council, the Committee, and the Admiralty would be parties. The letter was approved of."

Glasgow.—It would have been thought that the knowledge that gas was to be turned out, and not blown out, was common at least throughout Europe. Yet two Russians have been found unconscious in a Glasgow hotel through blowing out the gas before going to bed.

Hill of Beath.—An outbreak of fire occurred on Thursday at the gas-works of the Fife Coal Company at Hill of Beath, near Dunfermline. The fire was confined principally to the sheds in which were brick and pipe making machines. It is estimated that the damage done to machinery and buildings amounts to about £2000.

Paisley.—Two boys sustained injuries as the result of a gas explosion which occurred in Maxwelton Street, Paisley, on Friday. Some Corporation workmen were endeavouring to locate the escape, and the two boys, unknown to the men, joined in the search. One of them lighted a match, and held it close to the cover of a manhole. An explosion at once took place, and the boys and the heavy cover were hurled into the air. The boys' injuries were not of a serious nature.

Perth.—It is understood that there is nothing of a controversial character in the report made by Mr. Gillespie, of Glasgow, as to the state of the carbonizing plant, &c., at the gas-works. The report was under the consideration of the Gas Committee of the Town Council on Monday. The view of the Committee is that, where such a large extraordinary expenditure is involved, full consideration should be given to the subject before spending the money. For this purpose, the Gas Committee have invited Mr. Gillespie to Perth, so that the members may get elucidation on some points raised in the report. It is

also understood that the Committee have decided to ask the opinion of Mr. Vass, the Gas Manager, on several of the items mentioned in the report.

St. Andrews.—What threatened to be a serious fire broke out on Tuesday morning through an escape of gas in the purifier-house at the works of the St. Andrews Gas Company. The Company were able to continue the supply of gas, so that no inconvenience to consumers was experienced.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 28.

Sulphate of Ammonia.

The past week has been largely cut into by the holidays, but the market has remained very steady, and all parcels offered by tender have again been taken up at full prices. At the close, the nearest values are still £14 5s. per ton f.o.b. Hull, £14 6s. 3d. per ton f.o.b. Liverpool, and £14 7s. 6d. per ton f.o.b. Leith, although for urgent requirements rather more money has been paid. In the forward position, makers are holding for £14 12s. 6d. to £14 15s. per ton f.o.b. according to port of delivery; and it is reported that the latter figure has actually been scored for Leith shipment from January to June in equal monthly quantities.

Nitrate of Soda.

The position of this material is somewhat firmer, but spot quotations have not so far advanced again beyond 11s. 7½d. per cwt. for ordinary and 11s. 9d. for refined quality.

Manchester District Tar Prices.

It is officially announced that the average price realized for November deliveries of tar in the Manchester district—based on the value of the products—was 37s. 3d. per ton.

LONDON, *Dec.* 30.

Tar Products.

There is very little fresh to report concerning the market for tar products. Pitch is slightly higher in value; but there are not many new orders in the market. Benzols are quiet, and there is little business doing. Solvent naphtha is difficult to sell at the moment unless prices are lowered. Heavy naphtha is steady, and the demand is good. Creosote remains very firm.

The average values during the week were: Tar, 27s. 9d. to 31s. 9d. Pitch, London, 44s. to 45s.; east coast, 44s. to 45s.; west coast, Clyde, 44s. 6d. to 45s.; Manchester, 41s. 6d. to 42s. 6d.; Liverpool, 42s. 6d. to 43s. 6d. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 9½d. to 10d.; 50-90 per cent., naked, London, 10½d. to 11d.; North, 10d. to 10½d. Toluol, naked, London, 11d.; North, 10½d. Crude naphtha, in bulk, London, 5½d. to 5⅝d.; North, 5d. to 5⅛d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d.; North, 1s. 1d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10½d. to 11d. f.o.b. Creosote, in bulk, London, 3½d. to 3¾d.; North, 3d. to 3¼d. Heavy oils, in bulk, 3⅜d. to 3½d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 2s. 3d. to 2s. 4d.; forward, 2s. to 2s. 1d. nominal. Naphthalene, £5 to £9; salts, 45s. to 50s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

The improvement has been well maintained, and further business is reported at the increased values. Outside London makes are quoted at £13 8s. 9d. to £13 10s.; Hull, £14 5s.; Leith, £14 7s. 6d.; Liverpool, £14 6s. 3d.; Middlesbrough, £14 5s.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is now between the two holidays; and there is a moderate output and a full demand, with steamers waiting at the loading staiths. Naturally, the prices are firm, though there is little coal free for sale for a week or ten days, when the output should have returned to normal quantities. Best Northumbrian steams are from 15s. to 15s. 6d. per ton f.o.b.; and second-class steams are from 14s. Steam smalls are rather scarce, and are quoted at 10s. 6d. to 11s. 6d. per ton. In the gas coal trade, the demand is now at its fullest; and the production is very rapidly taken up. Best Durham gas coals are from 16s. per ton f.o.b. For second-class gas coals, 15s. 3d. is quoted; and for "Wear" specials, about 16s. 6d. per ton f.o.b. is the current price. Of course, it is well known that much of the production of gas coal is taken up by the long contracts, which absorb the largest quantities at this season of the year, and which are generally at prices that are considerably below those now ruling. There are no new contracts of moment now in the market, though, with the freights lower than they were six weeks ago, some sales are being made of cargoes for the Mediterranean ports—the delivered price being less than at the earlier date. Coke is very firm, with a strong demand. Gas coke is more plentiful, but maintains its price at about 21s. 6d. per ton f.o.b.

Scotch Coal Trade.

The coal trade is very active in Scotland, and practically all the coal is booked up for delivery until the end of the year. The prices on the Glasgow Coal Exchange at the end of the week were: Steam coal, 13s. 6d. to 14s. per ton f.o.b. Glasgow; splint, 14s. to 14s. 6d.; ell, 13s. 6d. to 13s. 9d.; trebles, 13s. 3d. to 13s. 6d.; doubles, 12s. 9d. to 13s.; and singles, 12s. to 12s. 6d.

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Diaries, Calendars, &c.

The close of an old year and the dawn of a new one always bring to the editorial office some useful remembrances from old friends; and on the present occasion we have to acknowledge the receipt of pocket diaries from the Gas-Meter Company, Messrs. F. C. Sugden and Co., and Messrs. Willey and Co.; calendars from Messrs. Clayton, Son, and Co., Simon-Carvès, Limited, and Stewarts and Lloyds; a blotting-pad and diary from Messrs. Parkinson and W. & B. Cowan; and two excellent little pictures from Messrs. Samuel Cutler and Sons, illustrating "A Century's Progress"—the first showing Samuel Clegg's gas apparatus, of 1815 (from a water-colour sketch), and the second a collection of modern plant constructed by Messrs Cutler and Sons. From Germany, comes a copy of G. F. Schaars' "Gas and Water Engineers' Handbook," published by Dr. E. Schilling.

Fatality through the Extinction of a Public Lamp.

While turning a corner in a rather narrow road at West Bromwich with a team of six horses drawing a 10-ton load, on the 24th inst., a carter named Joseph Withington, in the employ of the London and North-Western Railway Company, was pinned between the shafts of a waggon and a fence, and died next day from his injuries. At the inquest on Saturday, the question which claimed the attention of the Jury was whether or not a lamp which the Gas Committee of the Corporation had placed at this spot, which was generally regarded as a dangerous one, was alight at the time of the accident. Witnesses deposed that it was not, and that there was a strong smell of gas in its vicinity. The road had given way near the lamp, and one of the wheels of the waggon sank up to the hub, causing the vehicle to swerve on one side and crush the deceased. It was stated that shortly before the accident a team of eight horses belonging to the Railway Company, drawing a 13-ton load, had passed over the spot; and it was supposed that this heavy weight caused the gas-main to break and extinguish the light in the lamp. Other opinions were that the high wind had blown out the light. John Rogers, an employee of the Corporation, said he lit the lamp at about half-past four on the afternoon of the accident, and he always took special care with it, as he knew the spot was a dangerous one. The Jury considered the Gas Committee had done their best to minimize the dangers of the road by providing light; but they expressed the hope that the Corporation would carry out at the earliest opportunity a contemplated scheme of road widening at this place.

Mechanical Stoking and Coal-Handling Plant for Redhill.—The Directors of the Redhill Gas Company have decided, on the advice of Mr. W. H. Bennett, the Manager, to instal mechanical stoking and coal-handling plant in their new retort-house; and the contract for the whole of the work has been entrusted to Messrs. Cutler and Sons, of Millwall.

Gas Watch-Fires at the Emperor of Japan's Funeral.

We learn from the "Journal of the Imperial Gas Association of Japan" that on the occasion of the late Emperor's funeral the roads through which the procession passed were lighted by gas watch-fires, and that the arrangements in connection therewith were entrusted to the Tokyo Gas Company by the Imperial Household Department. Special men were selected for the work, and the laying of the main was commenced on the 22nd of August. Its length was about 3100 feet, and upon it there were 40 fires. Each was of 700-candle power, and was contained in a cast-iron vessel supported between poles 10 feet high. The flames rose some 3 feet; and their entire lighting power was 28,000 candles. The duty of lighting up and turning out the fires was entrusted to the lighters of the Company who possessed suitable qualifications; and they were under the direction of Captain S. Maeda, the Company's Engineer. Other installations of gas-watch fires were successfully carried out by the Company.

Public Lighting by Electricity at Hastings.

Mr. Charles F. Botley, the Assistant-Engineer and Electrician of the Hastings and St. Leonards Gas Company, has called the attention of the residents and ratepayers in Queen's Road and St. Mary's Terrace, Hastings, to certain facts which should be of considerable interest to them in connection with the adoption of electric light in place of gas for the public lamps. He points out that the Corporation paid £4 2s. 6d. each per annum for the two-burner gas-lamps in the Queen's Road. The charge for double electric lamps (two 55-watt lamps), according to the Official Year Book, is £5 19s. 2d. each per annum; but those in the road named are larger. For the gas-lamps in St. Mary's Terrace the Corporation paid £3 2s. 2d. each per annum; whereas the charge for electric lamps is stated officially to be £3 5s. 8d. The cost of conversion from gas to electricity is defrayed by the ratepayers in the general district rate. Mr. Botley points out that "to the end of the last financial year, and inclusive or exclusive of repairs to pavements, roads, &c., a sum of £1923 had been spent on this work of conversion," and that the recent expenditure in the two thoroughfares named and elsewhere is additional to this. After the conversion at the ratepayers' expense, the Electricity Committee, on certain assumptions which differentiate between this and all other current generated, claim a "profit" with current estimated at 2d. per unit. The total revenue expenditure for the last year averaged 2·4d. per unit sold; and Mr. Botley says the commercial folly of such assumption would have been at once apparent had not the charge for current to street arc lamps been increased from 3d. to 4d. per unit in July, 1909, thereby masking the effect. Last year, if the whole of the current for public arc lamps had been charged at 2d. per unit, there would have been a deficit on the accounts of practically £1100, instead of the small surplus. Apart from these indirect contributions, the Electricity Department is now indebted to the ratepayers for no less a sum than £15,548—the total deficiency in working.

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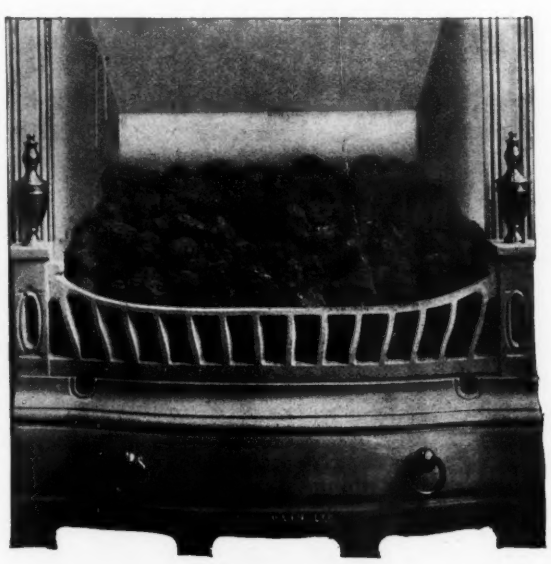

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Bishop's Waltham Water Supply.—The South Hants Water Company have entered into an agreement with the Bishop's Waltham Water Company, Limited, for the purchase of the undertaking for £11,212 and such further sum as will represent capital expenditure in excess of the issued capital of the selling Company. We learn that the purchase is to take effect on Jan. 1, 1914.

Extension of High-Pressure Gas Lighting for the Leeds Market Hall.—At the last meeting of the Markets Committee of the Leeds Corporation, they expressed themselves as so highly satisfied with the high-pressure gas lighting of the markets area with 1000-candle power lamps that they decided to extend the system to the Market Hall, for which Mr. Walter Hole, the Superintendent of the Gas Mains and Distribution Department, has been requested to prepare a scheme.

Bilston Gas Company.—In the report to be presented by the Directors of this Company at the annual meeting next Monday they state that, after paying the usual interim dividends, the profit and loss account shows a credit balance of £8846. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, and 4s. per share on the "B" shares; making with the interim dividends 11s. and 8s. per share respectively for the year, and leaving a balance of £6161.

Complaints of the Gas Supply at Shipley.—It appears that complaints have been made at Shipley with reference to the gas supply, and that the Engineer has reported in favour of the provision of additional condensing plant, &c., at an estimated cost of £1200. The matter was discussed at the last meeting of the Urban District Council, when Mr. C. B. Shaw, the Chairman of the Gas Committee, said a report had been found, dated 1900, in which Messrs. Newbigging and Son urged the old Gas Company to provide a new condenser. Mr. Moody remarked that it was a strange thing that the existence of this report was not mentioned until the members of the Council found serious fault with the gas supply. The naphthalene which was said to have caused all the trouble ought never to have been in the pipes. They had to pay very dearly for gas in Shipley, and it was high time there was a proper supply. Before the members separated, tenders were accepted for additional condensing plant.

Use of Incandescent Gas-Burners at Oldham.—At the last meeting of the Gas Committee of the Oldham Corporation, the General Manager (Mr. Arthur Andrew) stated, in reply to the Chairman (Alderman Herbert Wilde), that the proportion of users of incandescent burners in the borough was 75 per cent. Several members submitted that the users of the flat-flame burners were still very numerous in the area of supply, due largely to the fact that the people did not know how to take advantage of the incandescent system. Alderman Horrobin suggested that the public should be taught how to use gas in the way mentioned. Mr. Andrew observed that this was being done. He thought, however, they would have to go further, and establish a maintenance system; the Gas Department undertaking to keep fittings and mantles in proper order at a fixed charge per quarter. Mr. Coates remarked that this would apply to mills and chapels. Mr. Andrew said the mills were now getting more used to the incandescent system.

APPLICATIONS FOR LETTERS PATENT.

28,877.—Dunsford, F., "Gas-ring holder and economizer." Dec. 16.
28,934.—Heath, S., "Smoke and carbon consuming mantle." Dec. 16.
28,936.—Franks, A., and Sanders, G., "Gas-producers." Dec. 16.
28,943.—Siemens Bros. and Co., Ltd., "Quantitative analysis of gaseous mixtures." A communication from Siemens and Halske Akt.-Ges. Dec. 16.
28,972.—Rosen, J., "Coal-tar distillation." Dec. 16.
28,973.—Rosen, J., "Conversion of coal tar, &c., into pitch." Dec. 16.
28,989.—Pinder, J., "Shock absorber and gas deflector for mantles." Dec. 16.
29,001.—Rhodes, W. G., "Lighting open spaces." Dec. 17.
29,038.—Boeckem, F. W. O., "Rotary pumps, motors, or meters." Dec. 17.
29,046.—Hansen, C., "Gas-cookers." Dec. 17.
29,091.—Kettering, C. F., "Ignition systems." Dec. 17.
29,104.—Skaupy, F., "Electric gas lamps." Dec. 17.
29,105.—Heyl, G. E., and Baker, T. T., "Reinforcing the calorific value of fluid-fuel by the addition of hydrogen or other combustible gases." Dec. 17.
29,163.—Clement, J. M., "Packing mantles." Dec. 18.
29,182.—Kerpely, A. von, "Gas-producers." Dec. 18.
29,198.—Parr, T. D., "Air or gas compressors." Dec. 19.
29,204.—Boys, C. V., "Sun boiler." Dec. 19.
29,206.—Montgomery, C. J., "Compressor." Dec. 19.
29,212.—Anderson, H. P. H., "Pipe-connection." Dec. 19.
29,218.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Hot-plates in gas-boiling apparatus." Dec. 19.
29,219.—Hopkins, E. C., "Compressors." Dec. 19.
29,222 —Ponse, H. R. T., "Safety alarm for gas apparatus." Dec. 19.
29,275-6-7-8.—Bates, F. H., "Oil-gas producers." Dec. 19.
29,284.—Conan, W., "Incandescent gas-lamps." Dec. 19.
29,343.—Marsh, H., and Parkinson and W. & B. Cowan, Ltd., "Indicating-mechanism." Dec. 20.
29,348.—Hirst, H., and Cash, F. T., "Reflectors and shades for indirect lighting." Dec. 20.
29,365.—Hall, W. A., "Production of sulphur." Dec. 20.
29,371.—Koppers, H., "Discharging vertical retorts." Dec. 20.
29,379.—Cox, F. J., "Air-gas plants." Dec. 20.
29,433.—Garner, W. H., "Dust-proof burner attachment." Dec. 21.
29,452.—Shedlock, J. J., "Manufacture of combustible gases." Dec. 21.
29,457.—Anderson, D., "Gas-burners." Dec. 21.
29,499.—Testerheim, N., and Klauser, J. & A., "Stopping leaks in gas-pipes." Dec. 21.

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"Spiral-Circulator" with Manhole closed.

Its unique construction and the process of manufacture make it an appliance which is

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is practically

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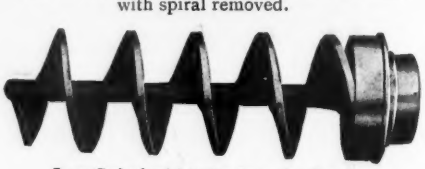

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Oldbury Gas Undertaking.—The gas undertaking of the Oldbury Corporation looks like having a record year, so far as the quantity of gas sent out is concerned. In a report issued last Saturday, the Gas Engineer (Mr. Adam Cooke) states that the output for the eight months ending Nov. 30 was 93,900,000 cubic feet, against 88,152,000 cubic feet for the corresponding period of last year; showing an increase of 5,748,000 cubic feet.

Gas v. Electricity for Heating and Cooking.—In view of the present strong advocacy by electricians of the superior claims of electricity for heating and cooking, it is not a little curious to find, as we have recently done, that at a certain large central electricity works and the substation gas is used exclusively for cooking and water heating; the various rooms in the offices, with the single exception of the electrical engineer's private room, being heated by coal.

Freshwater Gas-Works Flooded.—The weather at Christmas was decidedly not of what is called the "old-fashioned type." Instead of snow, the whole country was swept by torrential rain storms. The Isle of Wight suffered badly. At both East and West Cowes, houses and shops were inundated. At the Freshwater Gas-Works the fires were extinguished by the invading tide, and the mains were flooded, with the result that the western part of the island was in semi-darkness.

Ashford (Middlesex) Public Lighting.—It may be remembered that about a year since the Local Authority suggested the adoption of the Lighting and Watching Act for Ashford; but when the matter came to a poll of the inhabitants, the opponents of street lighting were able to muster just sufficient votes to prevent the Act being put into operation. Rather than allow the town to remain in darkness, a number of public-spirited residents submitted to a self-denying ordinance to allow themselves to be levied for a voluntary rate of 1d. in the pound to make a commencement with lighting some of the more important parts of the town; the result being that thirteen lamps were erected. So satisfied are the inhabitants with the lamps, that they have agreed to continue the payment of the voluntary rate, and extend the lighting by the erection of another thirteen lamp-standards in the new year. Much of the credit for this belongs to Councillor J. H. Tyars, to whose initiative, and the consequent work of getting the columns and lanterns, the town is greatly indebted.

Crowborough District Gas Company.—As already intimated, the Crowborough District Gas Company have given notice of a Bill for next session to enable them to raise additional capital, convert their shares into stock, and for other purposes. The shareholders met recently and approved of the promotion of the Bill. Mr. Andrew Dougall, who presided, explained that the Board had been busy the last two or three years bringing the manufacturing plant at the works up to modern conditions; and the standard now reached he said he believed to be up to the best gas-works practice. They now wanted some means by which they could sell their gas to a greater extent. With sufficient capital at their command, they could reach the consumers and give them appliances for the use of gas. In a rising place like Crowborough, the demand for gas should rapidly increase. The Board also thought that, when going to Parliament, they might as well ask for power to supply electricity in the district.

Following out the recommendations contained in the report of a Sub-Committee appointed to inquire into the wages and conditions of lower-paid workmen in the Corporation service, the General Purposes Committee of the Blackburn Corporation have resolved to bring up the wages of the several grades of labourers to 6d. per hour, to increase by 1s. the weekly wages of other employees, and to grant five days' holiday a year with pay.

The Welsbach Light Company, Limited, of Gray's Inn Road, W.C., forward a quantity of their advertising literature recently issued for distribution among the trade. Special mention may be made of the Welsbach-Kern gas-radiator catalogue, which illustrates a very full choice of patterns, and of a leaflet in colour dealing with the "Sovereign" and "Ruler" self-intensifying inverted high-power gas-lamps for indoor lighting.

The report for the year ended Sept. 30 of Messrs. James Milne and Son, Limited, states that there is a debit balance of £2151, in addition to which depreciation of plant, machinery, and buildings to the extent of £1125 falls to be charged, making a total of £3277. Adding the sum brought forward (£9109), there is a total to the debit of profit and loss of £12,386. The Company have sustained serious loss through a strike which has been running in one department for many weeks.

GAS COMPANIES' STOCK AND SHARE LIST.

Last week on the Stock Exchange was so seriously cut up—the two middle days being taken out of it by the holidays, and only two ragged ends left—that business was greatly impeded, and never aroused much animation. Impatience with the tedious protraction of the Peace Conference and the complete uncertainty as to what the upshot of it might be, were the sentiments generally entertained; and these enjoined caution. Movements, except in one or two minor lines, were slight; and some markets (Consols, for instance) did not move at all. The opening on Monday was discouraging; the failure of the Conference to make any substantial progress imparting despondency. Markets in general were weaker. Government issues were dull, Rails were almost inanimate with prices shrinking, but not severely, and American quotations showed a substantial fall, prompted by depression in Wall Street. On Tuesday, the tendency was rather firmer. Government issues looked stronger, and Rails were steady, while Americans were not so weak as the day before. The Exchange reopened on Friday with very quiet business; the settlement being the chief consideration. But the tendency was fairly good. Government issues were almost wholly unchanged, Rails were firm, with changes (if any) slightly up, and Americans moved similarly. The Foreign Market was more cheerful. Saturday was very quiet, except for settlement business; the final account of the year falling awkwardly. The day was featureless until nearly the close, when the further protraction of the Conference caused dissatisfaction. Consols closed unchanged at $74\frac{7}{8}$ to $75\frac{1}{8}$. In the Money Market, there was the usual strong demand at the close of the year. Business in the Gas Market was quieter than one was prepared for, even at this season, and was quite devoid of feature, except that of steadiness and solidity, which may be regarded as its fixed characteristic. In Gaslight and Coke issues, the ordinary had about half-a-dozen transactions—all at $106\frac{1}{2}$, except one at $105\frac{3}{4}$. In the secured issues, the maximum realized $84\frac{3}{4}$, the preference 101, and the debenture 76. South Metropolitan mustered two transactions, at 117 and $117\frac{1}{4}$. Commercial had one in the 4 per cent. at $107\frac{1}{4}$, and one in the $3\frac{1}{2}$ per cent. at $103\frac{1}{2}$—a rise of 1. Among the Suburban and Provincial group, Brentford new changed hands at 202, South Suburban at 119 free and $119\frac{1}{2}$, Tottenham "B" at 116, and (on the local Exchange) Liverpool "A" at 225. In the Continental companies, Imperial was marked at 176 and 177, and European at 19 and $19\frac{3}{8}$. Among the undertakings of the remoter world, Bombay was done at $6\frac{5}{8}$, Primitiva at $6\frac{9}{16}$, and ditto preference at $5\frac{3}{16}$ and $5\frac{7}{32}$.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	73–78	−2	6 8 2
374,000	Stk.	July 12	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
250,000	5	Oct. 11	$7\frac{1}{2}$	Bombay, Ltd.	$6\frac{1}{2}$–7	..	5 7 2
50,000	10	Aug. 29	15	Bourne-mouth Gas & Water } 10 p.c.	29–30	..	5 0 0
332,000	10	"	7	Do. B 7 p.c.	$15\frac{3}{8}$–$16\frac{1}{2}$	..	4 6 2
75,000	10	"	6	Do. Pref. 6 p.c.	14–$14\frac{3}{8}$	..	4 2 9
880,000	Stk.	Aug. 14	$13\frac{1}{2}$	Brentford Consolidated	257–262	..	5 3 1
330,000	"	"	$10\frac{1}{2}$	Do. New	198–203	..	5 3 5
50,300	"	"	5	Do. 5 p.c. Pref.	116–118	..	4 4 9
206,250	"	Dec. 12	4	Do. 4 p.c. Deb.	94–96*	..	4 3 4
218,230	Stk.	Aug. 29	11	Brighton & Hove Orig.	210–215	..	5 2 4
244,200	"	"	8	Do. A Ord. Stk.	152–155	..	5 3 3
530,000	20	Sept. 27	$12\frac{1}{2}$	British	$44\frac{1}{2}$–$45\frac{1}{2}$	..	5 9 11
120,000	Stk.	June 28	4	Do. 4 p.c. Deb. Stk.	91–93	..	4 6 0
245,771	Stk.	June 28	4	Buenos Ayres 4 p.c. Deb.	94–96	..	4 3 4
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. $4\frac{1}{2}$ p.c. Pref.	$3\frac{1}{2}$–$4\frac{1}{2}$	..	—
100,000	Stk.	June 28	$4\frac{1}{2}$	Do. $4\frac{1}{2}$ p.c. Deb. Stk.	73–77	..	5 16 11
157,150	Stk.	Aug. 29	5	Chester 5 p.c. Ord.	110–112	..	4 9 3
1,513,280	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Stk.	106–108	..	5 1 2
560,000	"	"	$5\frac{1}{4}$	Do. $3\frac{1}{2}$ p.c. do.	102–104	+1	5 2 6
475,000	"	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71–73*	..	4 2 2
800,000	Stk.	"	4	Continental Union, Ltd.	83–86*	..	4 13 0
200,000	"	"	7	Do. 7 p.c. Pref.	130–132*	..	5 6 1
492,270	Stk.	—	$5\frac{3}{4}$	Derby Con. Stk.	124–125	..	4 12 0
55,000	"	—	4	Do. Deb. Stk.	103–105	..	3 16 2
1,002,130	10	July 26	10	European, Ltd.	19–20	..	5 0 0
15,160,600	Stk.	Aug. 14	4/17/4	Gaslight and Coke } 4 p.c. Ord.	105–107	..	4 11 0
2,600,000	"	"	$3\frac{1}{2}$	$3\frac{1}{2}$ p.c. max.	82–85	..	4 2 4
4,062,235	"	"	4	4 p.c. Con. Pref.	100–102	..	3 18 5
4,531,705	"	Dec. 12	3	Coke 3 p.c. Con. Deb.	75–77*	..	3 17 11
258,740	Stk.	Sept. 13	5	Hastings & St. L. $3\frac{1}{2}$ p.c.	91–93	..	5 7 6
82,500	"	"	$6\frac{1}{4}$	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	16–$16\frac{1}{2}$	..	6 13 4
131,000	Stk.	Sept. 13	$7\frac{5}{8}$	Ilford A and C	154–157	..	4 17 1
65,780	"	"	$6\frac{1}{8}$	Do. B	121–123	..	4 19 7
65,500	"	June 28	4	Do. 4 p.c. Deb.	91–93	..	4 6 0
4,940,000	Stk.	Nov. 14	9	Imperial Continental	175–178	..	5 1 1
1,235,000	Stk.	Aug. 14	$9\frac{1}{2}$	Do. $9\frac{1}{2}$ p.c. Deb. Red.	86–88	..	3 19 7
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	122–125	..	4 16 0
561,000	Stk.	Aug. 29	10	Liverpool United A.	223–225	..	4 8 11
718,100	"	"	7	Do. B.	161–163	..	4 5 11
306,083	"	June 28	4	Do. Deb. Stk.	100–102	..	3 18 5
63,480	Stk.	June 28	3	Maidstone 3 p.c. Deb.	69–71	..	4 4 6
75,000	5	Nov. 28	6	Malta & Mediterranean	$4\frac{1}{2}$–$4\frac{3}{4}$	..	6 6 4
250,000	100	Oct. 1	$4\frac{1}{2}$	Met. of Melbourne } $4\frac{1}{2}$ p.c. Deb.	99–101	..	4 9 1
541,920	20	Oct. 30	$3\frac{1}{2}$	Monte Video, Ltd.	12–$12\frac{1}{2}$	..	5 12 0
1,775,892	Stk.	July 26	$4\frac{3}{8}$	Newc'tle&G'tesh'd Con.	$99\frac{1}{2}$–$100\frac{1}{2}$	..	4 7 1
529,705	Stk.	June 28	$3\frac{1}{2}$	Do. $3\frac{1}{2}$ p.c. Deb.	87–88	..	3 19 7
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.	$13\frac{1}{2}$–$14\frac{1}{2}$	..	5 1 5
300,000	Stk.	Nov. 28	8	Oriental, Ltd.	125–130	..	6 3 1
60,000	5	Sept. 27	10	Ottoman, Ltd.	$\frac{1}{2}$–$\frac{3}{4}$	..	5 14 3
60,000	50	Aug. 14	13	Portsea Island B	127–130	..	5 0 0
100,000	50	"	12	Do. C	124–127	..	4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.	$6\frac{1}{4}$–$6\frac{3}{4}$	..	5 18 6
499,960	5	June 28	5	Do. 5 p.c. Pref.	o–$6\frac{1}{4}$	..	4 15 3
521,600	100	Dec. 2	4	Do. 4 p.c. Deb.	96–98	..	4 1 8
346,198	Stk.	June 28	4	River Plate 4 p.c. Deb.	94–96	..	4 3 4
275,000	5	Apl. 12	12	San Paulo, Ltd.	13–14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	$11\frac{1}{2}$–12	..	5 0 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A	231–233	..	4 5 10
209,984	"	"	10	Do. B	230–232	..	4 6 2
523,500	"	"	10	Do. C	229–231	..	4 6 7
90,000	10	Sept. 27	$7\frac{1}{2}$	South African	$9\frac{1}{2}$–$10\frac{1}{2}$	..	7 2 10
6,429,895	Stk.	Aug. 29	5/9/4	South Met., 4 p.c. Ord.	116–118	..	4 12 8
1,895,445	"	July 12	3	Do. 3 p.c. Deb.	76–79	..	3 15 11
209,820	Stk.	Aug. 14	$8\frac{1}{2}$	South Shields Con. Stk.	163–165	..	5 3 0
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.	119–121	..	4 16 3
60,000	"	"	5	Do. 5 p.c. Pref.	117–119	..	4 4 0
117,058	"	July 12	5	Do. 5 p.c. Deb. Stk.	120–122	..	4 2 0
594,740	Stk.	Nov. 14	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Aug. 14	$7\frac{1}{2}$	Tottenham A 5 p.c.	142–145	..	5 0 0
483,940	"	"	$5\frac{3}{4}$	and B $3\frac{1}{2}$ p.c.	115–117	..	4 18 3
149,470	"	June 28	4	Edmonton 4 p.c. Deb.	94–96	..	4 3 4
182,380	10	June 15	5	Tuscan, Ltd.	$8\frac{1}{2}$–$8\frac{5}{8}$	..	5 15 11
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97–99	..	5 1 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	115–$115\frac{1}{2}$	..	4 6 7
255,636	Stk.	Aug. 29	$6\frac{7}{8}$	Wands-worth B $3\frac{1}{2}$ p.c.	139–142	..	4 16 10
85,766	"	June 28	3	3 p.c. Deb. Stk.	70–72	..	4 3 4

Prices Marked * are "Ex. Div."

A failure of the electric light at Rhyl recently plunged some of the principal shops in darkness for a couple of hours. At the post office, candles were requisitioned; and it is reported that "great inconvenience was generally experienced, most of the users of electricity having had the gas-fittings taken out"—a rash proceeding.

It was reported at the last meeting of the Heywood and Middleton Water Board that all the reservoirs were full and overflowing, which was quite a record—such a circumstance not having happened before since the Board was formed. The water in store was stated to be 696 million gallons, as compared with 513 million gallons last year, and equal to 214 days' supply.

Labourers in the employ of the Rochdale Water-Works Department have applied for an advance in pay of ½d. per hour – making the remuneration 6d. per hour. Before coming to a decision, the Water Committee have decided to make inquiries from other corporation departments employing the same kind of labour; the object being to get a uniform rate for the class of labourer concerned.

The Directors of the Shotley Bridge and Consett District Gas Company intimate that, owing to the increased cost of coal, the discounts allowed to ordinary consumers will be reduced from 10 to 5 per cent., commencing with the gas consumed after Jan. 1. The discount allowed to penny-in-the-slot meter customers will also be discontinued.

The many friends of Mr. Andrew Stephenson, of Palmerston House, E.C., will regret to learn that, just before the Christmas holidays, he had his office "burgled"—the booty consisting of a typewriter and a valuable old clock. The latter is a really serious loss, for the clock (which was known and admired by many of Mr. Stephenson's visitors) was one which it will be impossible to replace.

The Directors of the Houghton-le-Spring District Gas Company announce an issue by tender of 1000 6 per cent. preference shares of £10 each; the minimum price of issue being £10. Messrs. Corbet Woodall and Son have remodelled the works, and now supervise the concern as Consulting Engineers; and the further capital is required in connection with the rapid extension of the Company's business.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

CHIEF ASSISTANT ENGINEER. Staffordshire Potteries Water-Works Company. Applications by Jan. 20.

TECHNICAL SUPERINTENDENT. No. 5677.

DISTRICT AGENT AND CANVASSER. Tynemouth Gas Company.

CHIEF WATER INSPECTOR. Birkenhead Corporation. Applications by Jan. 11.

WORKING FOREMAN. Shepton Mallet Gas-Works.

FITTINGS CLERK. Smethwick Gas Department.

METER REPAIRERS. Blackburn Gas Department. Applications by Jan. 6.

SHOW-ROOM ATTENDANT. No 5675.

Appointments, &c., Wanted.

LEADBURNER AND CHEMICAL PLUMBER. No. 5673.

MANAGER OR ASSISTANT. No. 5678.

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Stocks and Shares.

GREAT YARMOUTH WATER COMPANY. By Auction. London Mart. Jan. 21.

HOUGHTON-LE-SPRING GAS COMPANY. By Tender. Jan. 14.

SHERINGHAM GAS AND WATER COMPANY. By Auction. London Mart. Jan. 21.

SOUTHEND WATER COMPANY. By Auction. London Mart. Jan. 21.

TENDERS FOR

Coal.

COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 11.

Condenser.

NELSON GAS DEPARTMENT. Tenders by Jan. 18.

Cookers and Grillers.

GLASGOW GAS DEPARTMENT. Tenders by Jan. 18,

Fire-Clay Goods, &c.

BANGOR (Co. DOWN) GAS DEPARTMENT. Tenders by Jan. 16.

DROITWICH GAS DEPARTMENT. Tenders by Jan. 14.

NELSON GAS DEPARTMENT. Tenders by Jan. 18.

ROTHERHAM GAS DEPARTMENT. Tenders by Jan 20.

SALFORD GAS DEPARTMENT.

Gasholder and Tank.

KEIGHLEY GAS DEPARTMENT. Tenders by Jan. 7.

Washer.

MANCHESTER GAS DEPARTMENT. Tenders by Jan. 10.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1913, are reminded that this can only be done during January.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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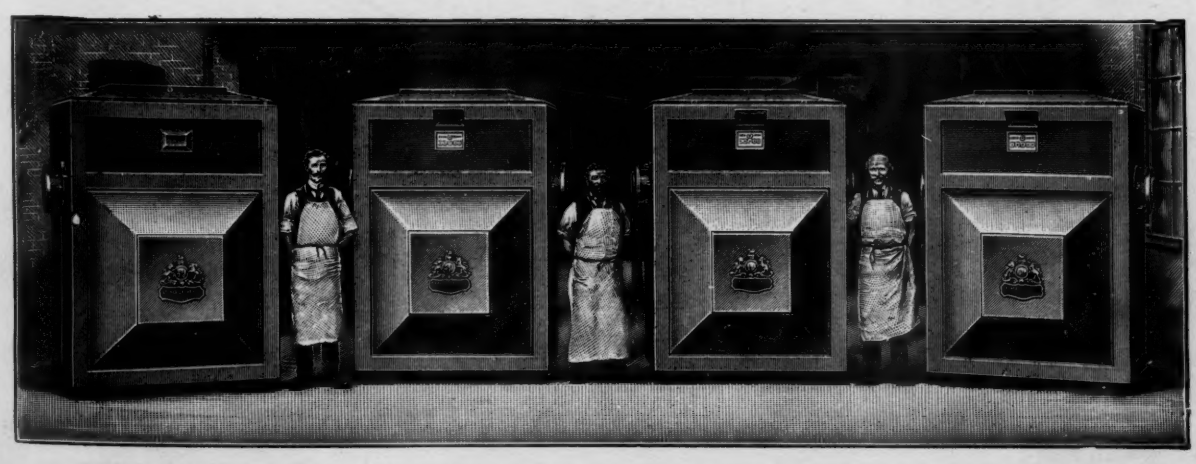

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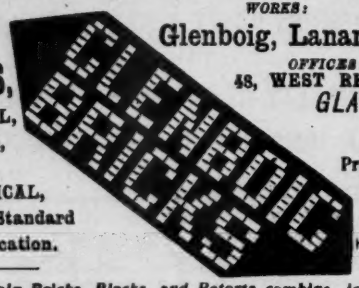

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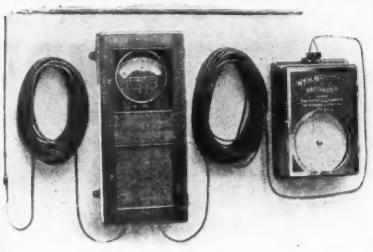

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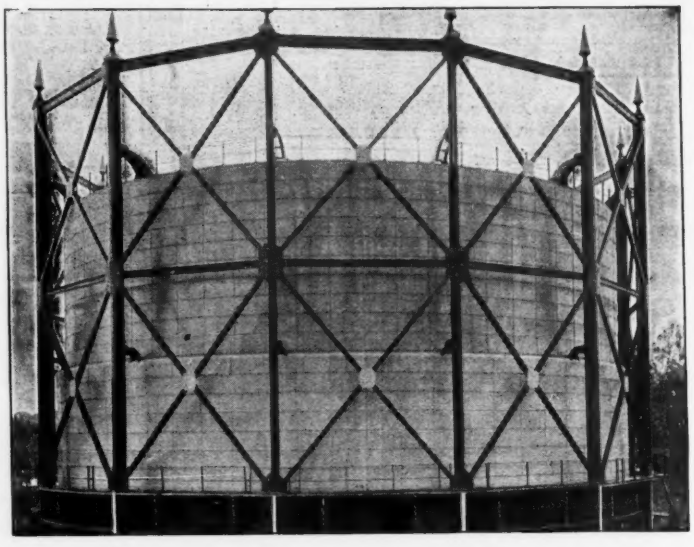

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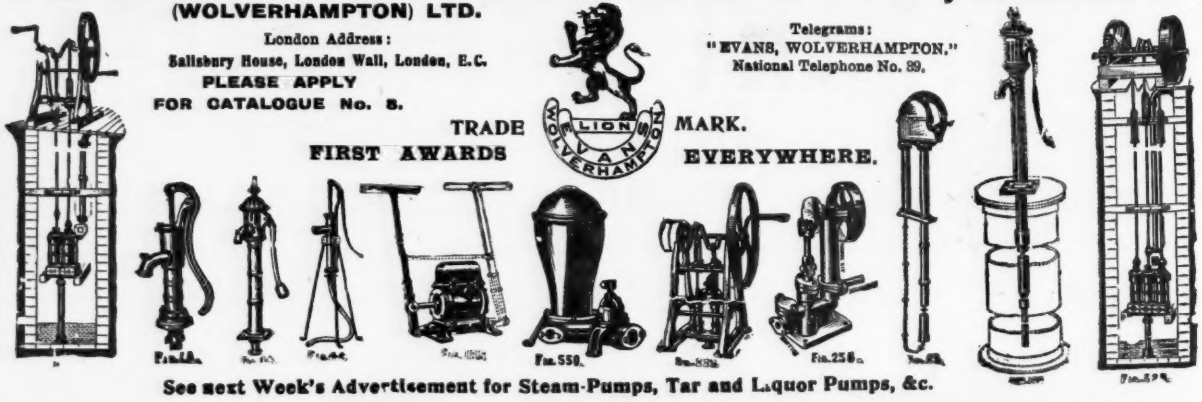

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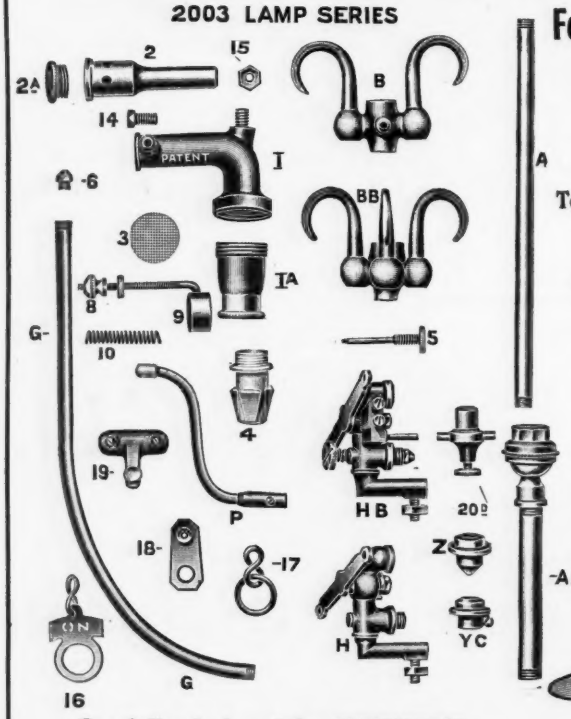

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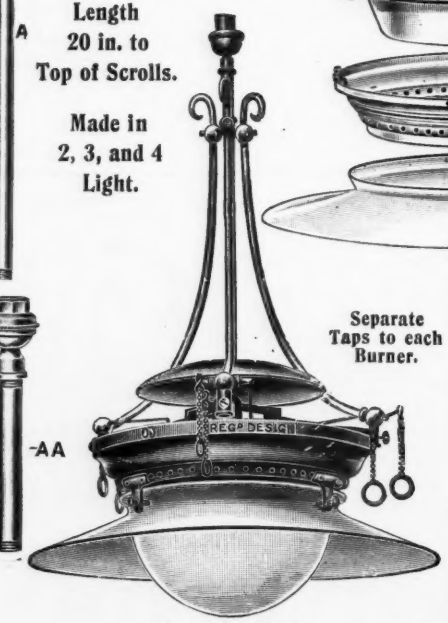
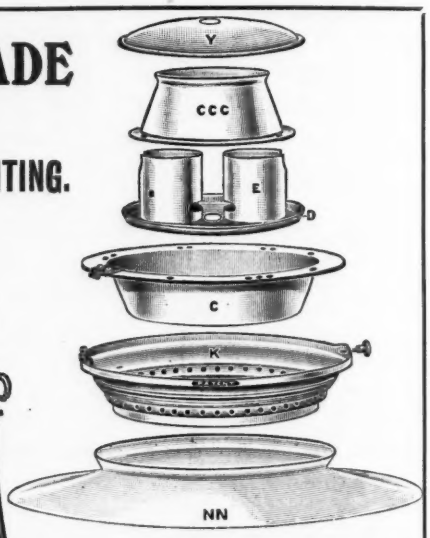


Separate Taps to each Burner.



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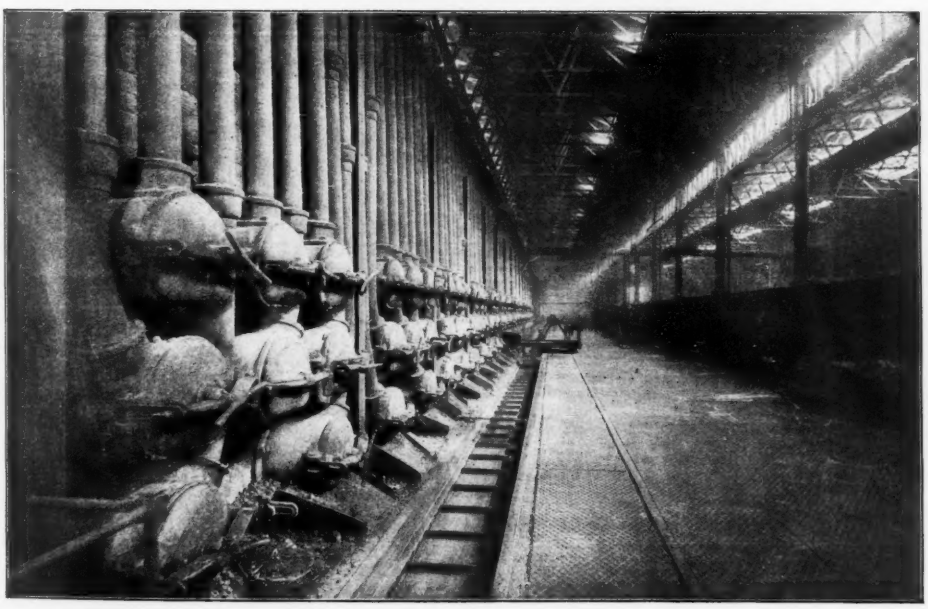

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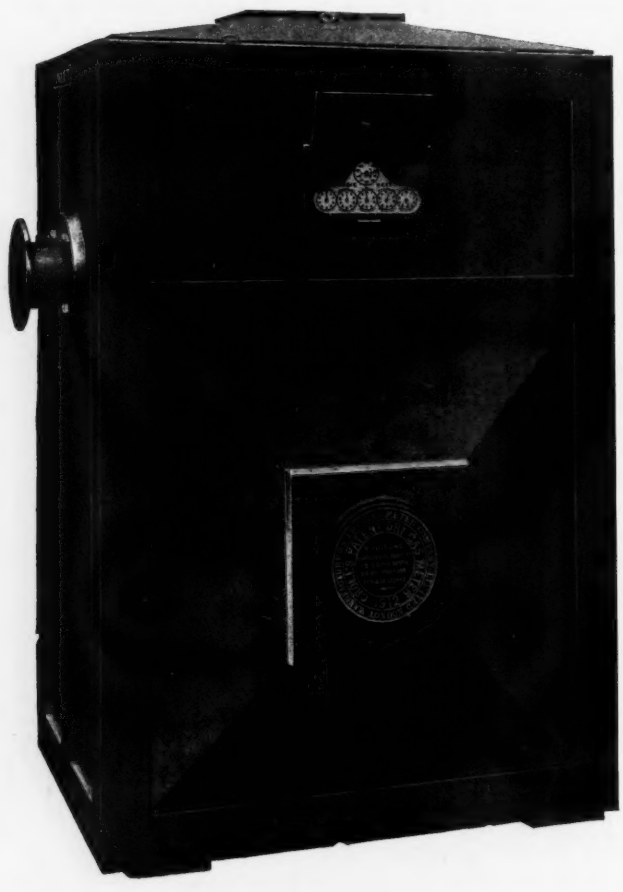

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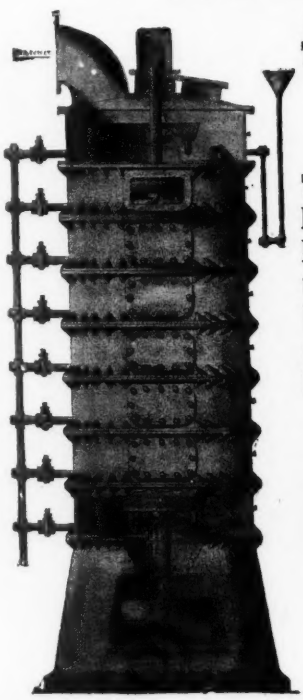

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Agram	200,000
Alkmaar	400,000
Allenstein	200,000
Alost	700,000
Amsterdam	1,000,000
Amsterdam (2)	1,000,000
Antwerp	1,500,000
Antwerp (2)	1,000,000
Antwerp (3)	1,500,000
Ashford	250,000
Augsburg	425,000
Aylesbury	150,000
Barmen	500,000
Barrow	300,000
Barrow (2)	500,000
Barry	500,000
Bath	1,000,000
Belfast	1,700,000
Belfast (2)	4,500,000
Benrath	125,000
Berlin:	
Charlottenburg	2,500,000
Rixdorf	650,000
Rixdorf (2)	700,000
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Nechells	3,000,000
Nechells (2)	3,000,000
Swan Village	1,500,000
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Bishop's Stortf'd	200,000
Bochum	530,000
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Bournemouth	1,000,000
Bournemouth (2)	500,000
Bremen	550,000
Bremen (2)	950,000
Bremen (3)	850,000
Brentford	1,200,000
Brentford (2)	850,000
Brentford (3)	350,000
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Bridlington	150,000
Bridlington (2)	200,000
Brieg	100,000
Brighton	1,750,000
Brighton (2)	1,850,000
Brighton (3)	750,000
Bristol	2,000,000
Bromley	1,500,000
Bruges	200,000
Brussels:	
Anderlecht	350,000
Anderlecht (2)	350,000
Forest	1,000,000
Koekelberg	1,000,000
St. Gilles	1,000,000
St. Josse	1,000,000
St. Josse (2)	600,000
St. Josse (3)	775,000
Ville	750,000
Ville (2)	750,000
Ville (3)	1,500,000
Ville (4)	350,000
Bucarest	1,100,000
Budapest	50,000
Budapest (2)	1,750,000
Budapest (3)	200,000
Budapest (4)	250,000
Cardiff	2,000,000
Carlisle	600,000
Carlsruhe	500,000
Chigwell	350,000
Chorley	300,000
Commercial, L'n.	850,000
Commercial (2)	850,000
Commercial (3)	1,250,000
Commercial (4)	2,000,000
Commercial (5)	800,000
Copenhagen	700,000
Copenhagen (2)	2,500,000

	Cubic Feet Daily
Courtrai	250,000
Coventry	600,000
Coventry (2)	600,000
Cracow	200,000
Cracow (2)	200,000
Crefeld	500,000
Crewe	700,000
Croydon	1,250,000
Croydon (2)	625,000
Croydon (3)	625,000
Croydon (4)	550,000
Debreczin	100,000
Deventer	150,000
Deventer (2)	200,000
Dorking	150,000
Dublin	2,000,000
Dublin (2)	2,000,000
Dublin (3)	650,000
Dundee	1,500,000
Dunedin	150,000
Dunedin (2)	275,000
Durham	200,000
Düsseldorf	1,000,000
Eastbourne	1,250,000
Edinburgh	2,000,000
Epsom	225,000
Epsom (2)	300,000
Essen	1,400,000
Falmouth	150,000
Faversham	200,000
Flensburg	300,000
Flensburg (2)	125,000
Forst	300,000
Frankenthal	175,000
Gas Lt. & Coke Co.:	
Beckton	10,000,000
Beckton (1910)	5,750,000
Beckton (1911)	2,875,000
Beckton (1912)	5,750,000
Bromley	3,750,000
Fulham	2,500,000
Kensal Green	2,250,000
Kensal Green (2)	2,250,000
Nine Elms	2,750,000
Gablonz	140,000
Gelsenkirchen	175,000
Gelsenkirchen (2)	350,000
Geneva	500,000
Geneva (2)	700,000
Gosport	200,000
Göteborg	300,000
Göteborg (2)	600,000
Graudenz	200,000
Grays	250,000
Guildford	350,000
Guildford (2)	200,000
Haarlem	850,000
Hamburg	1,750,000
Hampton Court	500,000
Hampton Court (2)	600,000
Hartlepool	750,000
Hebden Bridge	200,000
Heidelberg	200,000
Hilversum	850,000
Holyoke	600,000
Hong Kong	450,000
Hull	1,500,000
Hull (2)	1,000,000
Ilford	650,000
Ilford (2)	750,000
Innsbruck	200,000
Ipswich	750,000
Kampen	350,000
Karlsbad	350,000
Kiel	1,000,000
Kiel (2)	880,000
Kolozvar	100,000
Lausanne	250,000
Lausanne (2)	385,000
Lawrence	400,000
Lea Bridge	350,000
Lea Bridge (2)	350,000
Lea Bridge (3)	400,000
Lea Bridge (4)	1,000,000
Leeuwarden	400,000

	Cubic Feet Daily
Leiden	500,000
Leiden (2)	575,000
Leigh	350,000
Lemberg	260,000
Lemberg (2)	500,000
Liége	1,000,000
Liége (2)	750,000
Lincoln	500,000
Liverpool	3,500,000
Liverpool (2)	4,500,000
Liverpool (3)	750,000
Liverpool (4)	1,750,000
Longton	600,000
Louvain	800,000
Lübeck	400,000
Maastricht	200,000
Magdeburg	1,400,000
Maidenhead	225,000
Maidenhead 2	225,000
Maidstone	500,000
Malines	500,000
Malmö	350,000
Malta	400,000
Manchester	3,500,000
Manchester (2)	3,500,000
Manchester (3)	1,500,000
Mansfield	330,000
Marlborough	100,000
Mayence	700,000
McKeesport	500,000
Merthyr Tydfil	300,000
Middlesbrough	1,250,000
Moscow	1,000,000
Munich	1,400,000
Namur	175,000
Nelson	400,000
Newburgh	600,000
New York	5,200,000
Nictheroy	250,000
N. Middlesex	150,000
N. Middlesex (2)	200,000
N. Middlesex (3)	75,000
N. Middlesex (4)	650,000
Norwich	1,000,000
Norwich (2)	300,000
Norwich (3)	500,000
Nottingham	1,000,000
Nottingham (2)	1,000,000
Nuneaton	125,000
Oberhausen	175,000
Oldenburg	200,000
Ostend	100,000
Ostend (2)	200,000
Ostend, Zandvoorde	700,000
Perth, W.A.	125,000
Pontypool	120,000
Poole	1,500,000
Poole (2)	1,000,000
Port Elizabeth	400,000
Portsmouth	1,000,000
Portsmouth (2)	2,000,000
Posen	450,000
Posen (2)	700,000
Prague	140,000
Preston	1,400,000
Reading	1,000,000
Reading (2)	1,000,000
Redhill	275,000
Redhill (2)	300,000
Reichenberg	200,000
Reichenberg 2	200,000
Reval	350,000
Rhymney	175,000
Rhymney (2)	250,000
Ripley	120,000
Romford	300,000
Romford (2)	350,000
Rotterdam	850,000
Rotterdam (2)	1,500,000
Rotterdam (3)	750,000
Rotterdam (4)	750,000
Rotterdam (5)	600,000
Rotterdam (6)	2,000,000
St. Albans	700,000

	Cubic Feet Daily
St. Gallen	225,000
St. Gallen (2)	225,000
St. Joseph	750,000
San Paulo	700,000
Santiago, Cuba	400,000
Scarborough	800,000
Scarborough (2)	200,000
Shanghai	225,000
Shanghai (2)	225,000
Shanghai (3)	1,600,000
Southampton	800,000
Southampton (2)	500,000
Southampton (3)	600,000
Southgate	400,000
Southgate (2)	500,000
Southport	750,000
Southport (2)	00,000
South Shields	650,000
Stafford	500,000
Staines	600,000
Stettin	880,000
Stockholm	1,500,000
Stockholm (2	1,750,000
Stockport	600,000
Stockport (2)	600,000
Stockport (3)	400,000
Stockton	500,000
Stourbridge	500,000
Swansea	750,000
Swansea (2	1,000,000
Swansea (3	450,000
Swindon	300,000
Swindon (2	450,000
Sydney	1,000,000
Harbour	500,000
Harbour (2)	500,000
Mortlake	500,000
Mortlake (2)	500,000
Syracuse	850,000
Taunton	225,000
Taunton (2)	350,000
The Hague	1,000,000
The Hague (2)	500,000
Tilburg	400,000
Tirlemont	120,000
Tokyo	2,000,000
Torquay	350,000
Torquay (2)	350,000
Tottenham	750,000
Tottenham (2)	750,000
Tottenham (3)	350,000
Tottenham (4)	1,000,000
Tottenham (5)	1,000,000
Tottenham (6)	1,250,000
Tournai	700,000
Tunbridge Wells	1,000,000
Ulm	400,000
Utrecht	1,000,000
Utrecht (2)	1,000,000
Verviers	1,000,000
Vienna	3,500,000
Vienna (2)	2,500,000
Walsall	750,000
Waltham	400,000
Wandsbek	125,000
Wandsworth	1,800,000
Watford	300,000
Watford (2	350,000
Weimar	100,000
Wellington, N.Z.	350,000
West Bromwich	550,000
West Ham	1,500,000
West Ham (2)	800,000
Weston-Mare	350,000
Weston-Mare (2)	350,000
Wexford	100,000
Wiesbaden	850,000
Winchester	225,000
Winchester (2)	125,000
Wolverhampton	1,500,000
Zwolle	200,000
Zwolle (2)	200,000
Zwolle (3)	700,000

TOTAL CONSTRUCTION 1267 SETS; 972,700,000 CUBIC FEET DAILY.

36 & 38, VICTORIA STREET, LONDON, S.W. Bureau de Bruxelles, 209, Chaussée d'Ixelles.

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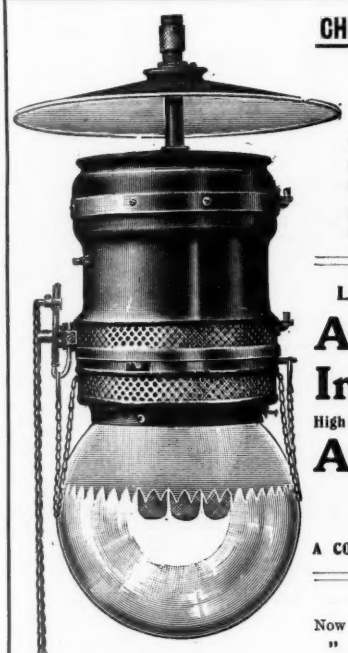

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Now made in	2 Light,	38s.	Complete.
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GAS LAMPS, INDOOR AND OUTDOOR, IN GREAT VARIETY.

We shall be pleased to send you our complete Catalogue. It will pay you.

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** and their improvement. **

Not only are many of the principal Gas Companies recommending the Foster Patent Gas Governor to their consumers, but, what is more, are themselves purchasing and installing on the hire system. This is because they have found after *actual* trial that this small device *does* improve gas lighting and heating.

Especially is this so with inverted mantles; these giving a steadier and brighter light, free from roar. The same, too, with Gas Fires and Cookers. May we send a

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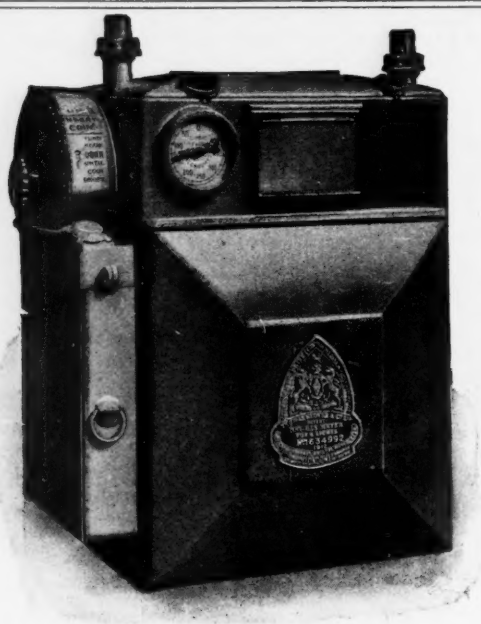
The Automatic Meter of THOMAS GLOVER.



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In addition to this, the price-change system is the simplest and requires no separate wheels.

And in the rare event of a coin fixing, no matter how damaged, release is easily effected without disconnection of the meter.

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For Pence, Shillings, or any Coin.

Fitted with

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SPECIAL TYPES
for the
EXTRACTION
of
HEAVY TAR,
TAR FOG,
NAPHTHALENE,
and
WATER GAS TAR.

May be fixed in the
RETORT HOUSE
or
EXHAUSTER HOUSE
or in the open.

ADVANTAGES:

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HIGH EFFICIENCY.

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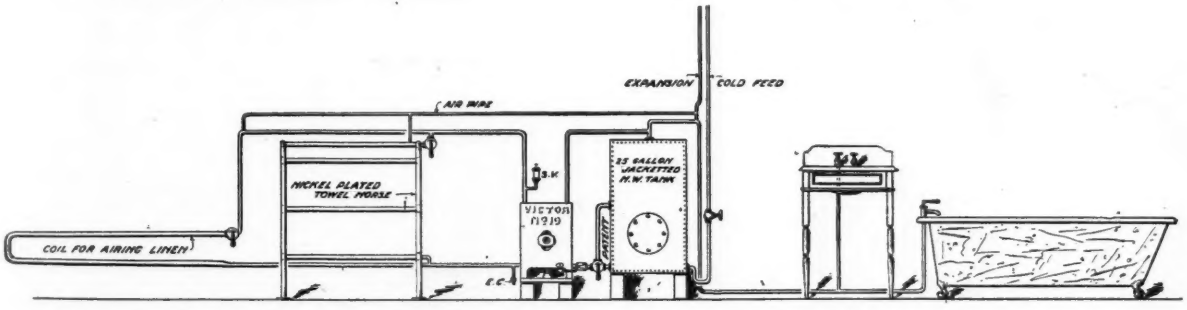
"VICTOR" GAS BOILERS

AT MAGDALEN COLLEGE, OXFORD.

A Complete Installation of Gas-Heated Hot Water Supply has been installed for the use of **H.R.H. THE PRINCE OF WALES** at Magdalen College, Oxford.



The "VICTOR" Boilers, although designed with cold water top sections, are adaptable to the reverse action, and this is an instance of the advantage afforded by the elasticity of the Victor system, which allows of almost every conceivable combination of apparatus.

The apparatus depicted here shows the low return requisite for a horizontal apparatus, without which it would have been impossible to provide the necessary equipment in this case.

THOMAS POTTERTON, *(Engineer) Patentee,*
BALHAM, LONDON, S.W.

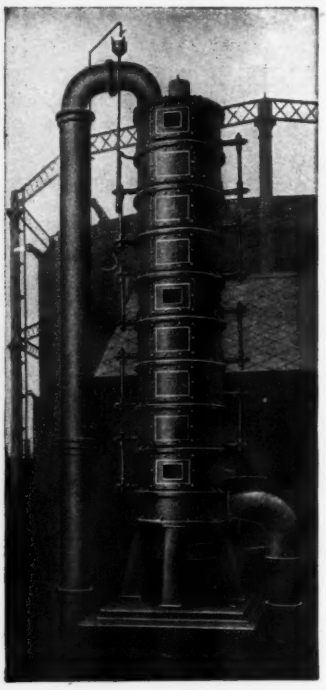
ROBERT DEMPSTER & SONS, LIMITED
ELLAND, Yorkshire.

Sole Agents for

SUMNER'S MECHANICAL WASHER.

(Patent applied for.)

Efficiency with Simplicity of Construction.



No Perforations, therefore cannot choke up.

High Strength Liquor obtainable.

Gas cannot Slip.

No Back Pressure.

Practically no Working Parts.

As erected at The Grays and Tilbury Gas-Works (Essex).

R. LAIDLAW & SON (EDINBURGH), LTD.
GAS METER MAKERS.

STATION METERS

IN

Ornamental Square & Round Cast-Iron Cases.

ALL SIZES.

Drawings, Specifications, and Prices on Application.

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AND
6, LITTLE BUSH LANE,
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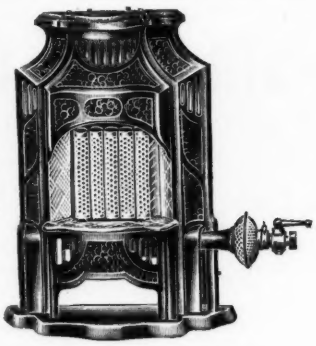

New Design.—O.K.

"GAS is too dear to burn regularly for Heating Purposes."

How often is this sentiment expressed, or, if not expressed, how deep-seated is

THIS FALLACIOUS IDEA

in the minds of the public.

You want a weapon to combat this idea—you have it at hand in the

Design 1 H.

Welsbach

KERN RADIATOR.

YOU want a fire which your consumers will use regularly—not one which they will leave alone after the first quarter's bill comes in, or use only as a stand-by when friends drop in.

THIS means you want an economical fire—in other words, a WELSBACH-KERN RADIATOR.

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Design 1 N.

New Design.—1 K.

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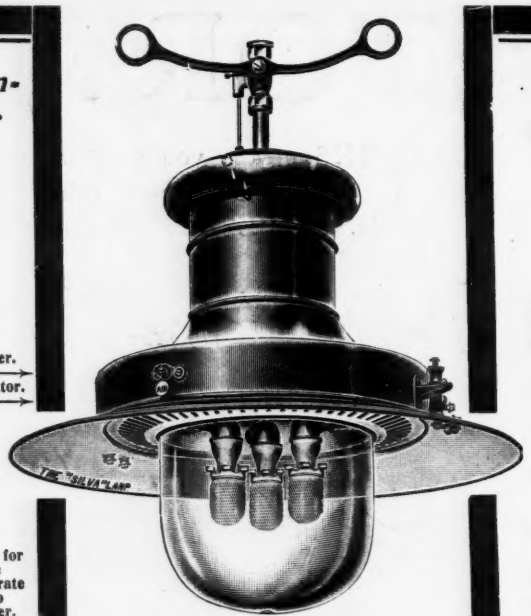

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Inexpensive to Instal and Maintain.

125 to 1000 Candle-Power at ordinary pressure.

"SILVA" Lamps are well made of stout gauge metal and are perfect in every detail.

Every part is easy of access and any lamp or part can be supplied from stock.

The Gas and Air Regulators are fitted outside the casing.

By simply lowering the Globe in Reflector the whole of the Interior is exposed for cleaning, &c.

They are more suitable and more economical for Lighting Shops and large areas than any other light made. The most important Gas Companies supply "SILVA" Lamps at a small quarterly rental including maintenance.

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Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
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Manufacture and keep in Stock at their Works (also large Stock in London)
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NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
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Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
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MIRFIELD GAS COAL
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Results obtained which have never been Surpassed by any other System of Carbonization.
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(Indicating & Recording)
THERMO-ELECTRIC (up to 1600° C.)
QUARTZ-GLASS RESISTANCE
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THE "BOYS" GAS CALORIMETER.

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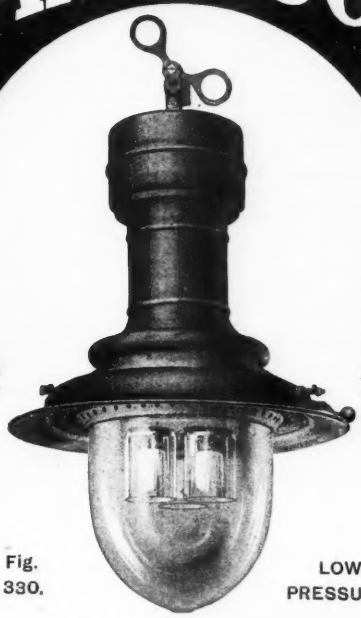
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INDICATING INCHES OF
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TYPE "A."
FOR USE WITH H.P. PLANTS.

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FOR RETORT HOUSE, EXHAUSTER HOUSE, &c.

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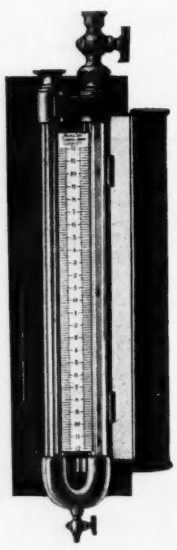

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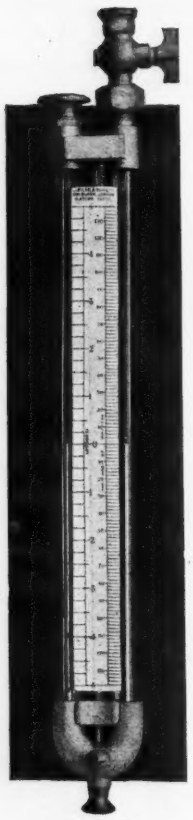
WITH PROTECTIVE TIN COVER.



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INDICATES INCHES OF WATER COLUMN
AND LBS. PER SQUARE INCH.
FOR USE WITH H.P. PLANTS.

No. 7b.
A PILLAR GAUGE
WITH TAPER PLUG.
Can be Supplied with
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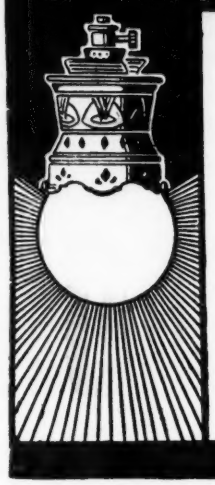

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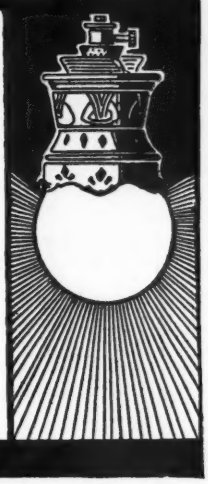

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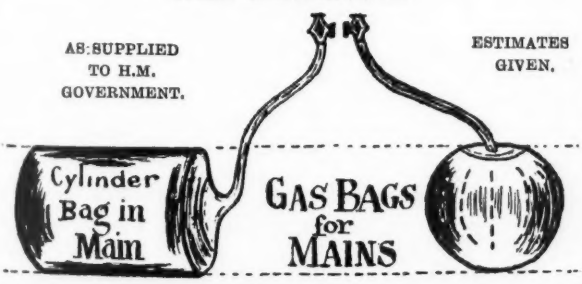

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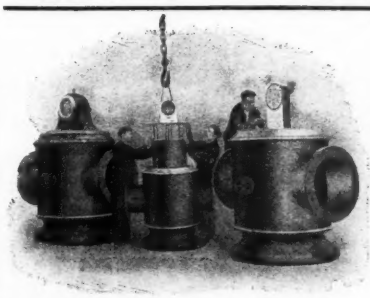

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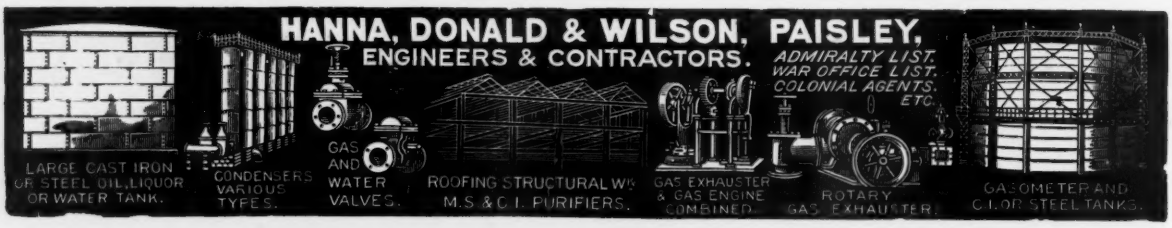
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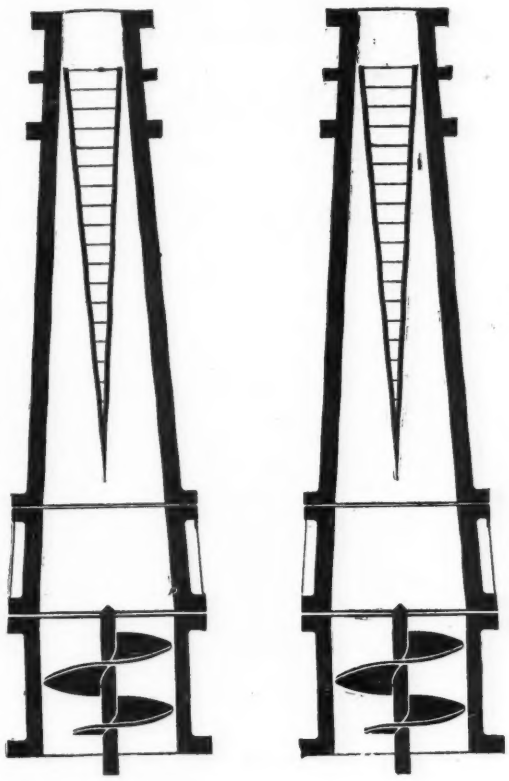

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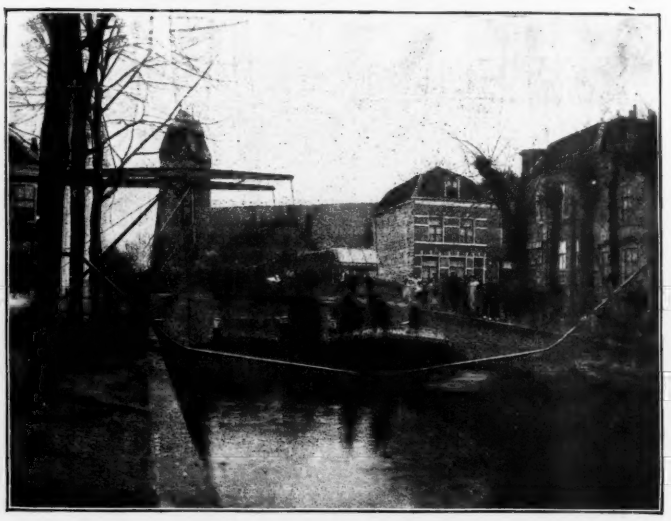

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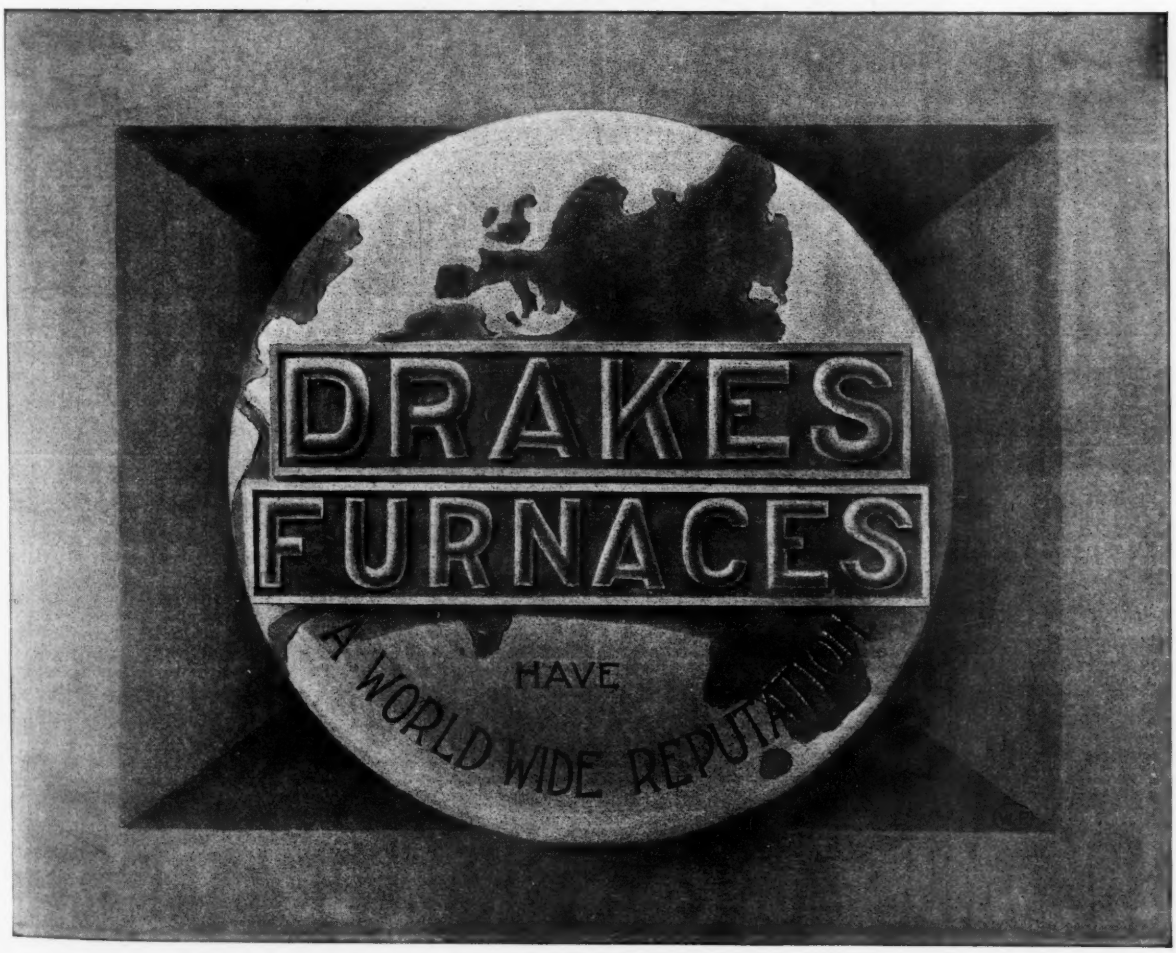

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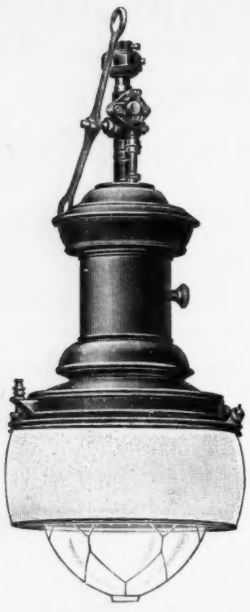

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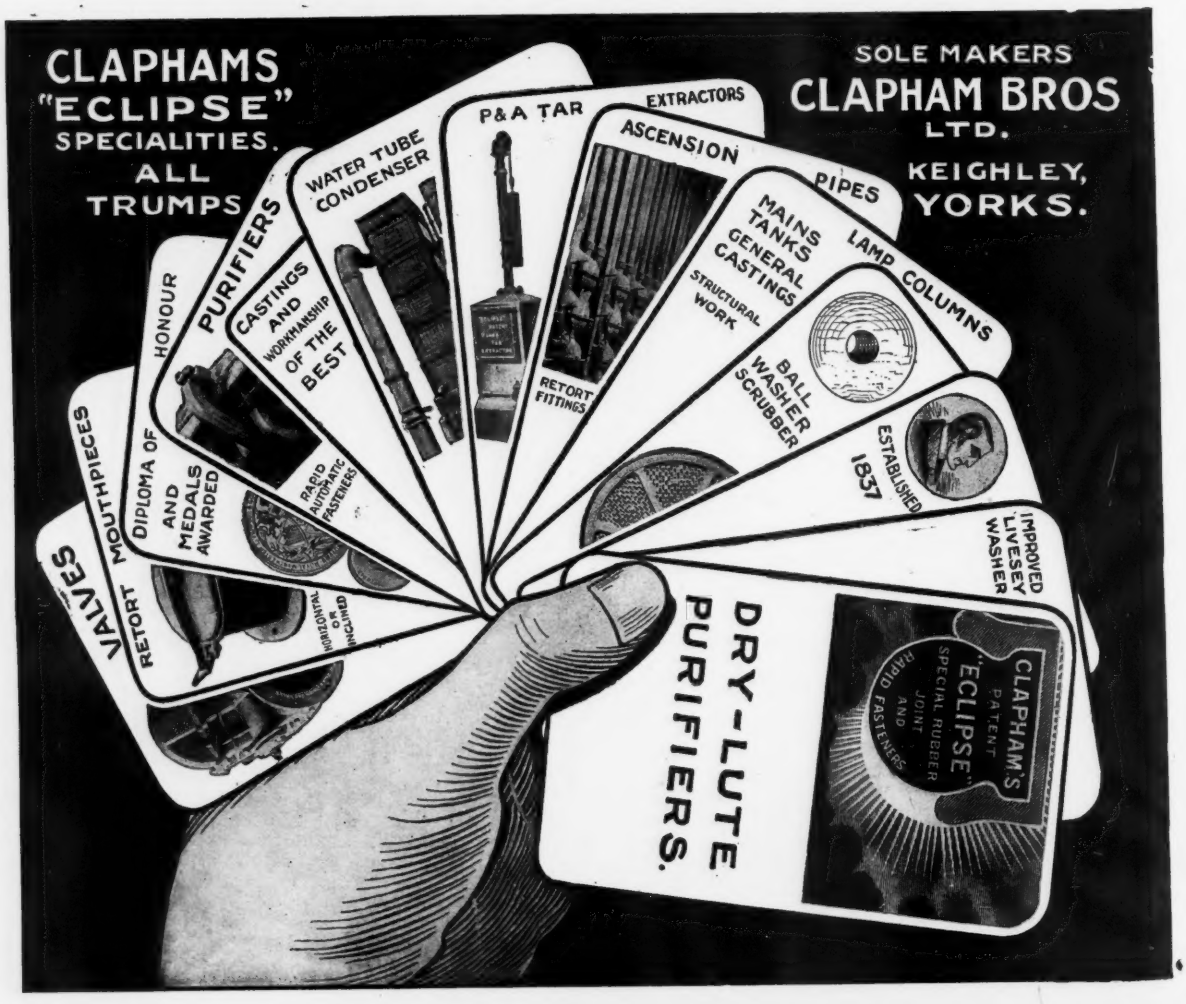

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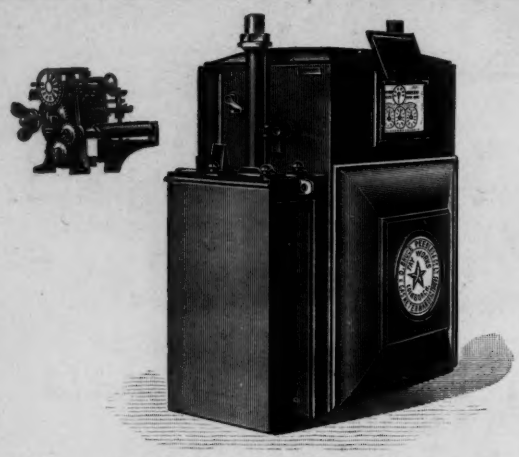

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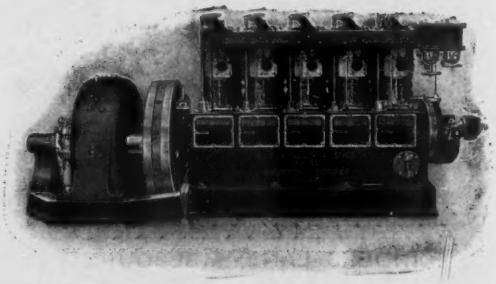

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